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Fall 1986
Volume 30
Number 4

Mariners Weather Log

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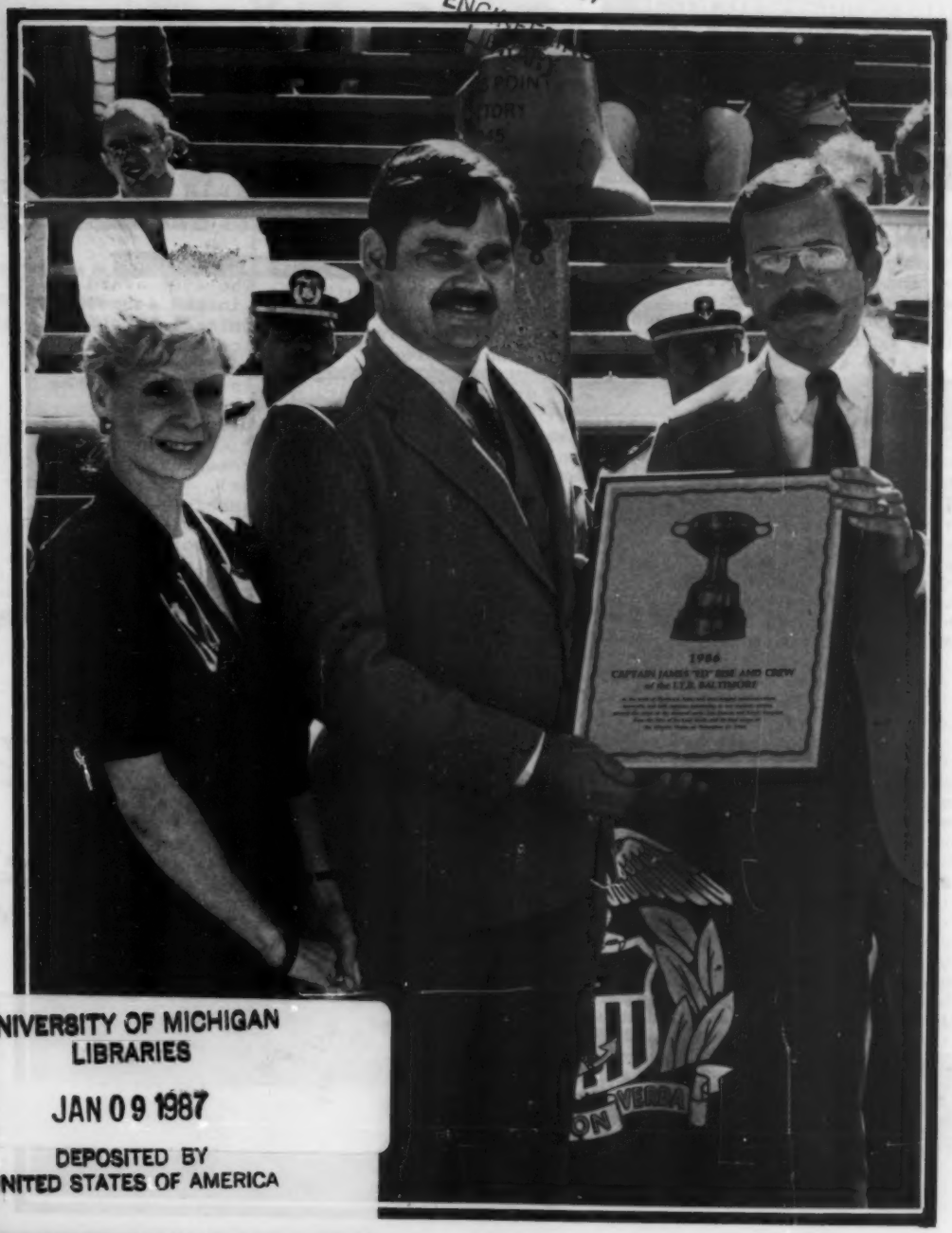

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HONORING A SKILLED SHIPMASTER

The citation read in part: "The extraordinary seamanship skills of Captain Bise and the heroic, persistent and gallant efforts of his crew under extreme weather conditions uphold the highest traditions of the sea. In saving human life and in the demonstration of excellent qualities of seamanship, Captain James Edward Bise, Jr., and the crew of the ITB BALTIMORE qualify as the winners of the 19th American Merchant Marine Award".

Captain, his wife and the trophy

On a dark, dreary November night the ITB BALTIMORE, loaded with jet fuel, gasoline and heating oil, was battling out-of-season hurricane Kate (1985) some 200 miles north of St. Croix, V.I. At 3 a.m. the Second Mate heard the first of several garbled messages from a Coast Guard search plane, reporting a vessel in distress. After several fruitless hours of trying to contact the San Juan Coast Guard, he tried and reached Radio WOO in southern New Jersey. They patched him through to San Juan, which relayed the TAXI DANCER's position. Six hours later, after diverting his 47,000-ton tanker, Captain Bise sighted the stricken 42-foot yacht. After manuevering, a feat difficult in ordinary seas, to prevent the small craft from being crushed, the BALTIMORE's Chief Engineer and First Assistant took deck positions to pull the survivors aboard. Waves were breaking over the bow, while the wind-whipped Second Mate fired three shots, from the Kilgore Gun, before a line could be secured to the TAXI DANCER. Survivors scaled the Jacobs ladder to safety by 11 a.m. Some two hours later the BALTIMORE found the liferaft of the 65-foot yacht SUNQUEST. Their poition had been transmitted by an Emergency Position Indicating Radio Beacon, which had a broken antenna replaced by a crewman, who used a pair of first-aid scissors to cut a spiral metal strip from a soft drink can.

After three perilous tries and despite a snapped mooring line, the raft was brought alongside and its crew members struggled aboard the BALTIMORE. By 2 p.m. the ship resumed her journey to Port Redding, New Jersey with the collective crews of the two yachts safely onboard.

The Seamanship Trophy was established in 1962 by the U.S. maritime community to honor acts of distinguished seamanship by American citizens. This perpetual cup is preserved as permanent tribute to deeds of extraordinary American seamanship and maritime skill. A unique award, it is not necessarily given every year.

The 1986 award is the 19th in the series. It recognizes achievements of American seafarers in calendar year 1985.

As defined by the Select Committee (comprised of maritime labor, management and government representatives), "distinguished seamanship" includes either a distinguished act of professional competence in the presence of extreme peril to life or property, or an outstanding feat of seamanship exemplifying the highest standards of professional competence under severe, adverse weather conditions.

The Seamanship Trophy normally remains in the possession of the awardee for half the calendar year from the date of presentation and otherwise is on permanent display at the American Merchant Marine Museum located on the grounds of the U.S. Merchant Marine Academy at Kings Point, N.Y.

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Mariners Weather Log

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November-December 1986
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EDITOR: Richard M. DeAngelis
GRAPHICS: Wilhelmenia L. Bowe

Routing Master _____

Observing Officers

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Radio Officer _____

PARTICIPATE IN AMVER & IGOSS

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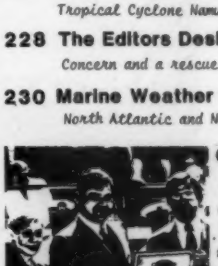

Cover:
Flanked by his lovely wife., Captain James Edward Bise receives American Merchant Seamanship Award from Maritime Administrator John Gaughan. Story opposite.
Photo courtesy of The U.S. Merchant Marine Academy.

Back Cover:
A view of hurricane Charley over Cape Hatteras by professional photographer Michael Halminski. Story on page 224.

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through April 1, 1988.

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"Three Sisters" Mar Histori

—by Jerome W. Nickerson
Marine Weather Consultant*

Early maritime history is filled with tales of explorers searching for a "Northwest Passage". However it wasn't until 1985 that a single ship accomplished the feat of sailing the Northwest Passage to encircle the North American continent.

On the last leg of the historic voyage the USCG icebreaker POLAR SEA (fig. 1) was rocked by a series of freak waves during the night of October 25, 1985. She was a little more than 300 miles northwest of Seattle, her destination. As the ship rolled violently, three crewmen lost their handholds and fell, slid, and rolled the length of the 85-foot wide bridge. One died while two others were injured. Injuries also occurred in other parts of the vessel and one required hospitalization. The ship was struck by two groups of very high waves that "came from a different quarter" than the other waves in the seaway. This ship rolled both ways an estimated 50 degrees. Although the incident occurred at night, during the height of a rapidly worsening storm, the waves appear to have been two sets of "three sisters" extreme storm waves. This is a label given to extreme storm waves that usually appear in groups of three. An extreme storm wave is a subset of freak waves.

"... The waves appear to have been two sets of "three sisters" extreme storm waves".

The POLAR SEA left Seattle June 6th and proceeded to the East Coast via the Panama Canal. There, they received orders to make a supply voyage to the Air Force Base at Thule, Greenland. On August 1, the POLAR SEA departed Greenland and headed west through the islands and floe ice in what is known as the "Northwest Passage", which links the Atlantic and Pacific Oceans via the

Figure 1.-- The 399-foot icebreaker POLAR SEA in her natural environment.

* Now retired, Jerry was the Marine Observations Program Leader for NOAA. He now lives at RD2, Box 52 Purcellville, VA. 22132

riVoyage

Arctic Ocean. The first U.S. ship to use the Northwest Passage was the specially constructed, icebreaking tanker, the MANHATTAN, in 1969 (fig. 2). However, the MANHATTAN was accompanied by two Coast Guard icebreakers.

Except for a small oil leak in a propeller, the voyage was routine until October 25th. The POLAR SEA was overrun by a rapidly intensifying storm that night and the following morning .

Figure 2.-- Converted tanker MANHATTAN was a 150,000-ton, 1005-foot vessel in 1969-- where is she now?

During the most intense part of the storm, at about 1000 (2 AM local time), two groups, "three or four waves", came out of the storm from a different direction, more abeam, and struck the POLAR SEA. The ship was at 49.9°N, 128.4°W, about 20 miles west of Cape Cook, Vancouver Island.

Reporting Freak Waves

Freak waves, and the subset, extreme storm waves, have been sinking and damaging ships since man has been going to sea. However, there is no means of rapidly reporting the occurrence of a freak wave. Through the World Meterological Organization (WMO) and the international convention for safety of Life At Sea (SOLAS) there are proven methods for rapidly reporting icebergs. This, however, did not come until after the TITANIC disaster. Must we wait for a freak wave incident of this proportion? Freak wave warnings are vital to other vessels in the area. Knowing some of the characterstics of a freak wave, such as the direction from which it is coming, could mean the difference between a ship disappearing and surviving. There is a need for a method of rapidly reporting the occurrence of a freak wave by some international procedure similar to the reporting of icebergs.

When an unexpected incident of this nature occurs, it is important for both the mariner and the National Weather Service to find out what happened. The first procedure was to gather all the possible information about the incident. We then replotted, reanalyzed, and where possible, verified the information. The Port Meteorological Officer at Seattle, Donald Olson and Dr. Frank Gonzalez, Pacific Marine Environmental Laboratory (NOAA), were particularly helpful in this regard.

Although the winds from the POLAR SEA were estimated, their observations were consistent with other ship and buoy reports in the area. During the actual incident, there were no other ship reports in the immediate vicinity for comparison.

During much of the year, there is a semipermanent low pressure system in the Gulf of Alaska. To the south is the generally east-west oriented polar front that separates the cold polar air from the warmer maritime air. Frontal waves, which may develop into storms, form and generally move eastward along the front.

On October 25th the front was between 40° and 45°N. (fig. 3). At about 43°N, 168°W a small, rapidly moving frontal wave developed into the storm that generated the extreme storm waves.

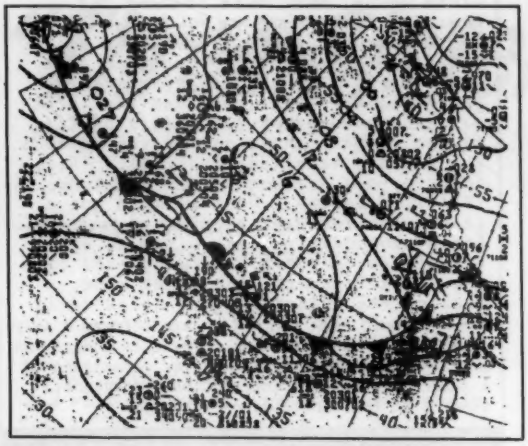


Figure 3.-- Synoptic situation that eventually led to the tragedy.

The high resolution infrared satellite image (fig. 4), shows the storm coming over the horizon in the upper left. It already shows signs of being intense, as indicated by the white core area surrounded by black at the center of the wave. On figure 4, below the line of number and letters, is a shading scale that represents the temperature of the clouds, land and water that the satellite senses. The darker shades of gray are warmer temperatures, which become progressively cooler in the lighter shades to the right. Under the "UC5", the temperatures are very cold indicating that the clouds are very high. This occurs when updrafts of thunderstorms force clouds to great heights and indicates intense development. By 0000 Saturday, October 26th there was still nothing unusual on the surface weather map (fig. 5). The strongest reported wind in this system was 35 knots at 46.2°N, 131.0°W, some 300 miles south of the POLAR SEA. The POLAR SEA's winds were from 140° at 19 knots. Most of the coastal winds are at airports, in mountain valleys, and are not representative of conditions offshore.

When air flow is constricted the air speed increases and the pressure drops proportionally to the increase in wind speed. This is called the venturi effect. As the low pressure system approached the coast, the mountain range along Vancouver Island, with peaks above 7000 feet, and the 10,000-foot peaks in the Coastal Range on the mainland, formed a barrier to eastward air flow. The cold, dense air was forced over the mountains or was accelerated northward between the mountain

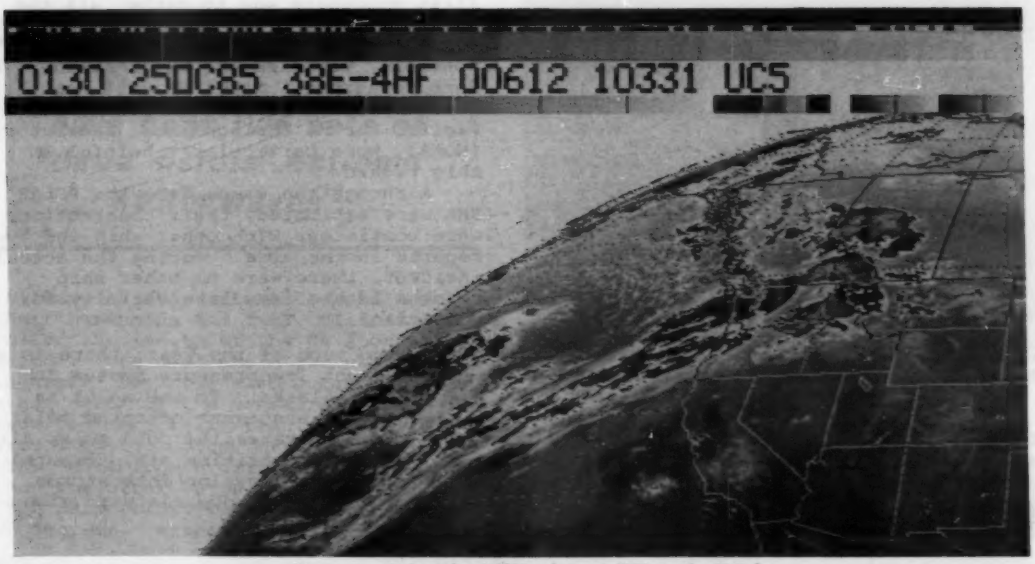


Figure 4.-- Infrared satellite photo at 0130 on the 25th.

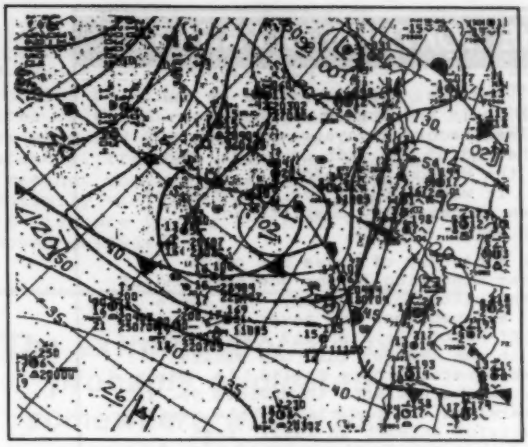


Figure 5.-- A more organized, but not unusual, some 24-hours later.

barriers and the intensifying storm offshore.

This produced a venturi effect in streaks of super gradient wind parallel to the isobars and the mountain barrier. The POLAR SEA was in the pocket between the mountains and the intensifying storm. She apparently sailed into one of these streaks of very high wind.

Figure 6 indicates a significant increase in the "cold tongue" west of the low and a clearing or thinning of the clouds, along the coast, ahead of the warm front. The clearing "cold tongue" behind the storm generally indicates intensification of the storm, and the coastal clearing often indicates some venturi effect. However, the

"No one actually saw the waves as it was nighttime and raining."

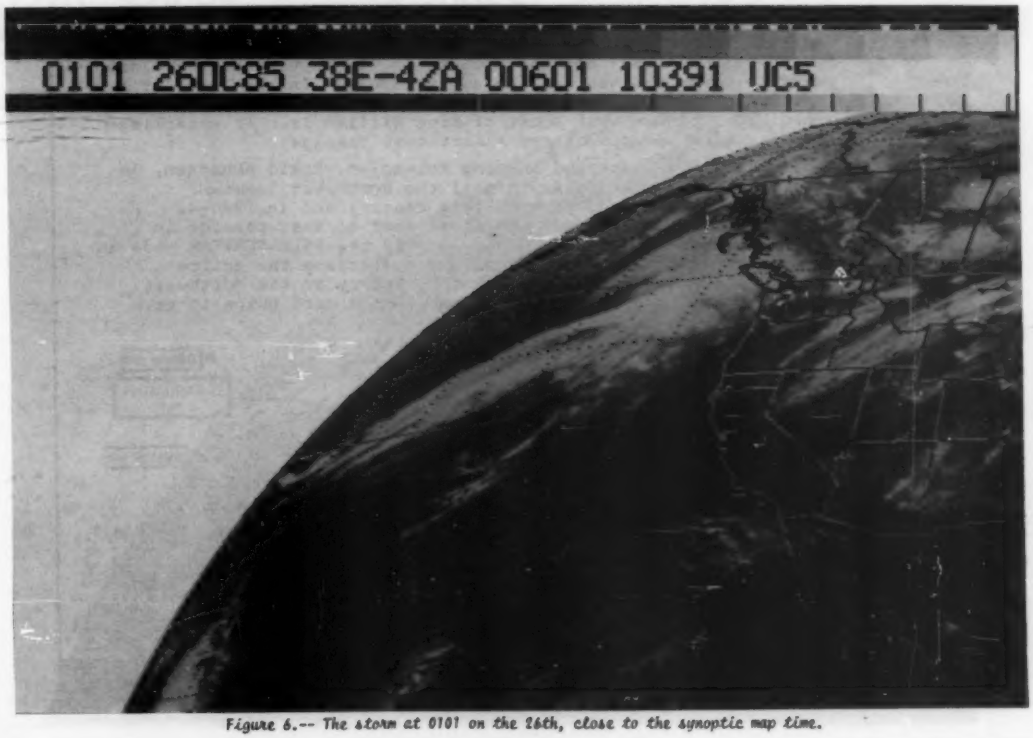


Figure 6.-- The storm at 0101 on the 26th, close to the synoptic map time.

THE SEARCH FOR THE NORTHWEST PASSAGE

A search for the Northwest Passage, was undertaken by the English to avoid conflict with Spain and France along the southern trade routes. The first recorded voyage was made by John and Sebastian Cabot at the end of the 15th century. Many early expeditions sailed into the Hudson Bay before it was established as an inland sea. It wasn't until the beginning of the century that Roald Amundsen successfully complete an east-west crossing entirely by ship.

Between these voyages lies a history of brave but often tragic attempts. In 1611 after wintering in the southern end of Hudson Bay, Henry Hudson was the victim of a mutiny. He and a few others were cast adrift in an open boat and never seen again. Captain James Knight wrecked off Marble Is. in 1719 and it was not until 48 years later that it was learned that his entire expedition had perished. After several others failed, Lt. Parry navigated Parry Channel as far as the entrance to McClure St. in 1819-20. James Clark Ross determined the position of the North Magnetic Pole during an unsuccessful attempt in 1832. Even though, by 1845 it was realized that the Northwest Passage had little commericial significance, the search continued. The British Admiralty dispatched Capt. Sir John Franklin and Capt. Crozier in 1845. In 1847 they navigated Peel Sound to Victoria St. where the vessels were subsequently frozen in and abandoned. During that rugged year Franklin died. Crozier and the other survivors all perished while attempting to make their way south from King William Island. In the course of this final journey they closed the last gap in the Northwest Passage.

From, 1847-1859 many relief expeditions set out to search for Franklin and his vessels. These and subsequent searches, funded by Lady Franklin, established four possible routes for the passage. Among the more important discoveries were the Bellot St by the PRINCE ALBERT and the M'Clure St. by Capt. Robert M'Clure searching from the west in the early 1850's. In the late '50's Capt. Leopold M'Clintock found the only written record of the expedition, on the west coast of King William Is. It established that Franklin had discovered a Northwest Passage.

In the 1903-06 period a young Norwegian, Roald Amundsen, in the GJOA, became the first to sail the Northwest Passage. Explorations continued through this century and in 1940-42 Sergeant Henry Larsen made the first west to east passage in these schooner SAINT ROCH. Then in 1969 the SS MANHATTAN made an east-west passage. The POLAR SEA, by encircling the entire continent, has taken its place in the history of the Northwest Passage. But like many others, there was a hard price to pay.

real indication of major intensification shows in figure 7. The bird-shaped bright white area surrounded by black is quite possibly an area of thunderstorms about 100 miles wide and 200 miles long. Apparently, from the POLAR SEA's cloud and weather observations, this area of potentially violent weather passed a short distance to the south of them as it moved eastward.

"The extreme storm waves probably originated somewhere within the most violent part of the storm . . ."

At 0300 the POLAR SEA's wind speed increased from 19 to 30 knots, and reached 42 knots the following hour. The wind continued to increase to a high of 67 knots with maximum gusts of 80 knots (table 1).

POLAR SEA -- OCTOBER 26, 1985

Time GMT	Lat N	Long W	Cse. Deg.	Wind D	Spd.	Pres. Mbs	Weather	Wave Meter	Swell Meter
00	51.2	130.9	133	140	19	1013.0		1/2	1
03	50.7	129.9	129	140	30	1009.3	MOD.or HVY SW	1	1
04	50.6	129.7	132	130	42 G64	1007.8	Rain	1 1/2	(STORM)
06	50.3	129.2	126	130	49 G76	1003.5	MOD.or HVY.SW	2	(STORM)
07	50.1	128.8	123	130	G58 G80	1001.9	"	3	(STORM)
08	50.1	128.6	130	140	G64 G75	999.5	"		(STORM)
09	50.0	128.5	125	140	G76	997.7	"		(STORM)
10	49.9	128.4	120	140	G60	995.7		3 1/2	(STORM)

Freak Wave report at 1000Z. Data on waves unknown because of darkness and moderate to heavy rain showers. Damage to ship was minor equipment damage, numerous electrical grounds and many things broke their securing straps. Personnel casualties - one dead, 3 injured.

Table 1.-- Weather conditions aboard the vessel.

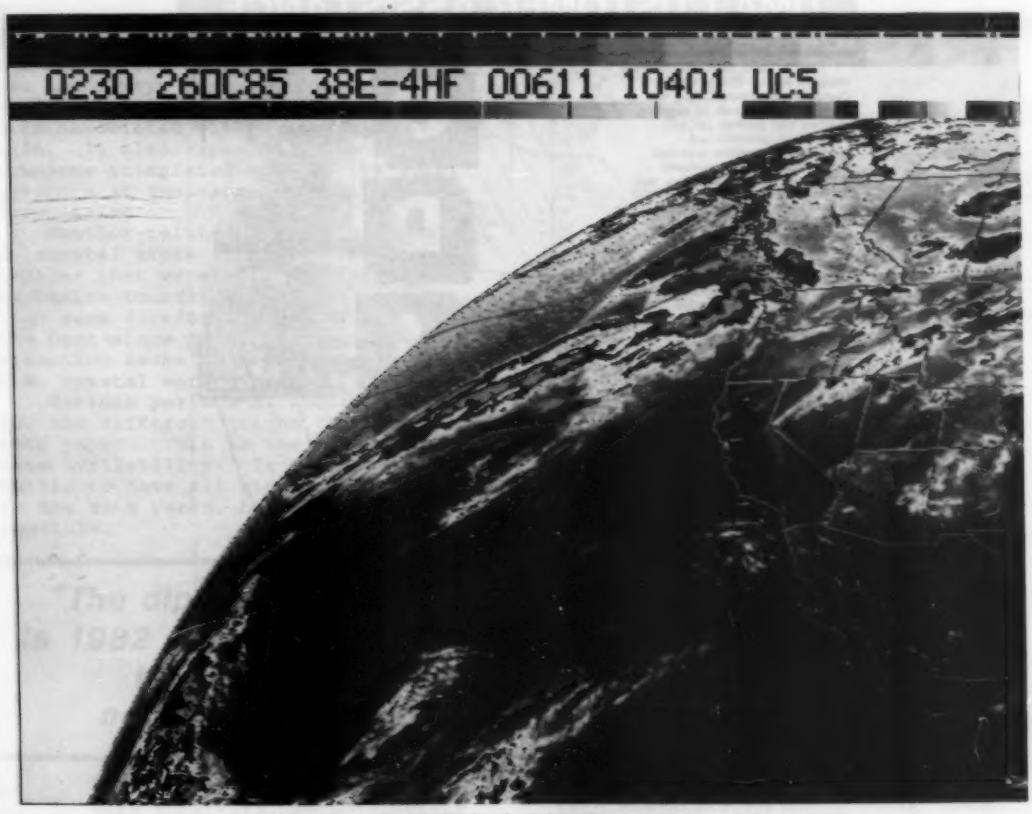


Figure 7.-- At 0230 (26th) the infrared gives a better view.

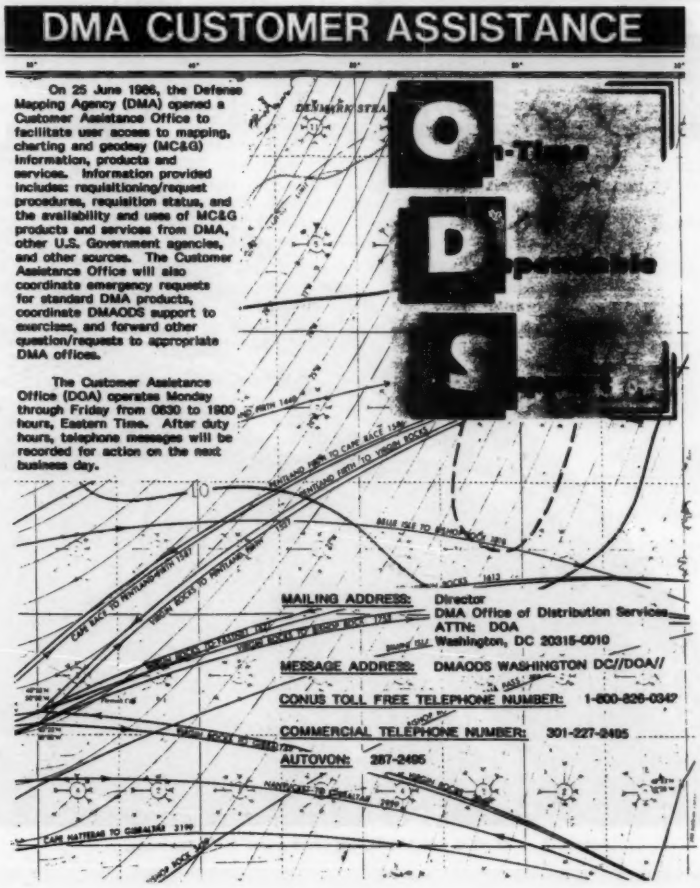
The extreme storm waves came in two groups of three or four waves ("three sisters") from a different direction than the other waves, at approximately 1000. No one actually saw the waves as it was nighttime and raining. However, the consensus was that the extreme storm wave came more from the starboard beam, or the southwest. At the time, the POLAR SEA was on a heading of 120° with a wind of 60 knots from 140°. The extreme storm waves probably originated somewhere within the most violent part of the storm; this would be from the south to the southwest which seems consistent with the observations. After the wave groups struck, the heading was changed to 150 degrees. No other extreme storm waves were reported.

The waves in the seaway, about 20 degrees on the starboard bow, were reported at 3.5 meters (about 11 feet). The waves that struck the POLAR SEA and caused the catastrophic rolls, came from the starboard beam and were estimated to be about 35 feet. While they weren't high in comparison to many reported freak waves, they fit the criteria of being at least twice as high as the waves in the seaway.

Icebreakers have a more rounded shape to their underwater hull than most ships, which, though necessary in ice, makes them roll easier in open water. This hull design and the direction of the freak wave groups coming from abeam, were contributing factors in the deep rolls of the POLAR SEA.

We appreciate the U.S. Coast Guard sharing the information on the POLAR SEA incident and deeply regret the loss of life and injuries to the officers and men.

DMA CUSTOMER ASSISTANCE


On 25 June 1986, the Defense Mapping Agency (DMA) opened a Customer Assistance Office to facilitate user access to mapping, charting and geodesy (MC&G) information, products and services. Information provided includes: requisitioning/request procedures, requisition status, and the availability and uses of MC&G products and services from DMA, other U.S. Government agencies, and other sources. The Customer Assistance Office will also coordinate emergency requests for standard DMA products, coordinate DMAODS support to exercises, and forward other question/requests to appropriate DMA offices.
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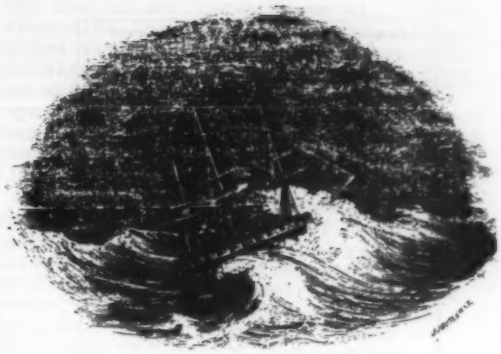
Weather and Maritime Casualties



--by Robert G. Quayle
National Climatic Data Center
Asheville, NC

Lost at sea. No none knows many souls count this as their epitaph. The list grows ever longer. Going to sea has always involved danger, which no doubt explains part of the romaticism associated with a seafaring life. It also explains why maritime commerce stimulated some of the first attempts at insurance and weather forecasting.

Weather-related casualties cluster in coastal areas (fig.8). This implies that we should continue to emphasize coastal weather as well as high seas forecasting. This has been the case since 1976, although the situation seems to be improving in U.S. coastal waters.

Various periods of record are used for the different graphs throughout this paper. This is the result of data availability. It would have been better to have all statistics relate to the same years, but this was not possible.

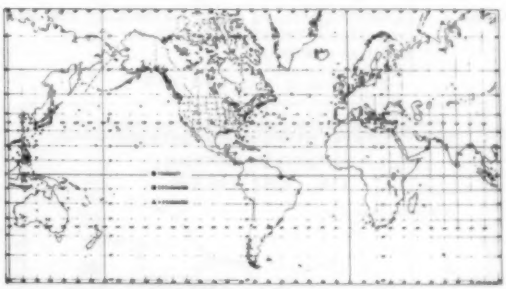


Figure 8.-- 886 major weather-related casualties; notice the coastal cluster.

"The dip in ship reports in 1982 seems to be partly the result of a new ship code . . ."

To make forecasts, meteorologists must have data. Figures 9 and 10 show the growth in marine data sources, including moored buoys and coastal stations. The dip in ship reports in 1982 seems to be partly the result of a new ship code, introduced by the World Meteorological Organization in January 1982, and partly the result of decreased numbers of ships calling at U.S. Ports (U.S. Department of Commerce, 1970-1984), as shown in figure 10.

A couple of other points are apparent from figure 10. Many reports that are mailed in are not received by radio. This is a significant source of untapped data. Also, the number of buoy and C-MAN (Coastal Marine Automated Network) reports has surpassed the number of reports from U.S. ships in recent years. There is an apparent absence of a strong seasonal fluctuation in the number of ship reports. It would appear that, overall, high seas shipping does not have a strong seasonal cycle. The

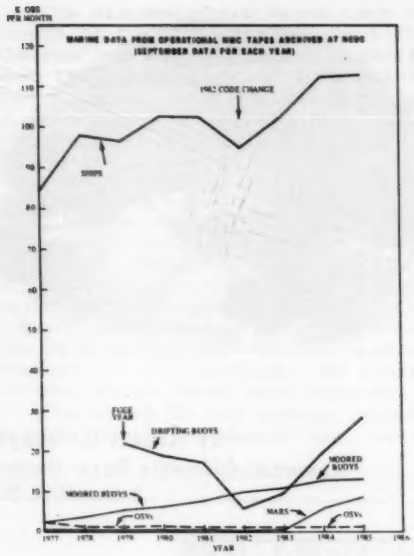


Figure 9.-- September samples of marine observations. OSV are ocean station vessels while MARS are marine reporting stations.

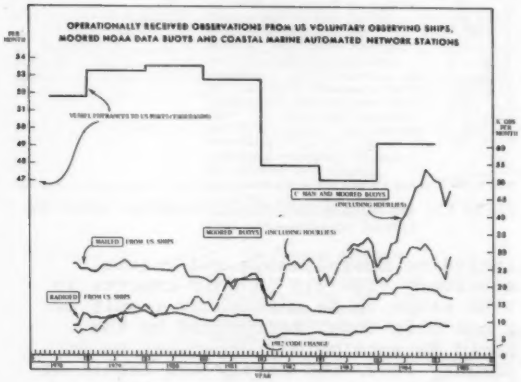

OPERATIONALLY RECEIVED OBSERVATIONS FROM US VOLUNTARY OBSERVING SHIPS, MOORED NOAA DATA BUOYS AND COASTAL MARINE AUTOMATED NETWORK STATIONS
MOORED BUOYS (INCLUDING HOURLIES)
MAILED FROM US SHIPS
RADIOED FROM US SHIPS
1982 CODE CHANGE
YEAR

Figure 10.-- Approximate monthly number of observations (right hand scale) for data received at the National Climatic Data Center. Also vessel entrances to U.S. ports (left hand scale); annual totals are horizontal lines.

seasonal variation in buoy reports is partly the result of decommissioning Great Lakes buoys in winter and, to a lesser extent, the result of decreased reliability of buoy instruments in harsh winter weather. Although there was an apparent reduction in shipping to and from U.S. ports in 1982, the overall trend, since 1970, has been more tonnage in fewer and larger ships

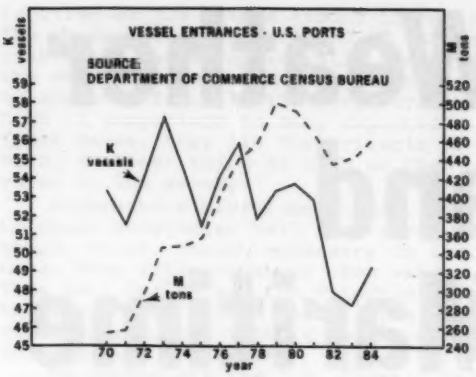


Figure 11.-- Vessel entrances to U.S. ports (Source: U.S. Dept. of Commerce).

as shown in figure 11.

Having set the stage for a review of casualty statistics, let's first investigate the U.S. coastal area. Figures 12 and 13 are based on the U.S. Coast Guard Proceedings of the Marine Saftey Council (1964-1980), which contains annual statistics received from U.S. commercial vessels (including fishing and inland types) whenever a casualty results in any of the following:

(a) Actual physical damage in excess of $1,500.

(b) Material damage affecting the seaworthiness or efficiency of a vessel.

(c) Stranding or grounding (with or without damage).

(d) Loss of life.

(e) Injury causing any persons to remain incapacitated for a period in excess of 72 hours (except injury to harbor workers not resulting in death and not resulting from vessel casualty or vessel equipment casualty).

". . .The number of weather-related casualties has been fairly constant . . ."

In this study, weather-related means that weather was listed as the primary cause of the casualty. Weather is probably implicated as a secondary contributing factor in many more casualties than are shown as having weather as the primary cause. A "casualty" means a "vessel" (in figure 12, i.e., if two vessels are damaged in a collision, the incident would count as two casualties). The Coast Guard report format changed in 1980 and data were not summarized after that year for this article. Figure 12 shows that while casualties seem to be increasing the number of weather-related casualties has been fairly constant and thus the percentages that were weather-related decreased. Similarly, figure 13 shows that the dollar losses from all casualties increased, while the dollar losses from weather-related casualties actually tended to drift downward from the mid 1960's to 1980. Actual reported dollar amount and dollar amounts adjusted for inflation to "1985 constant dollars" are both shown in figure 13.

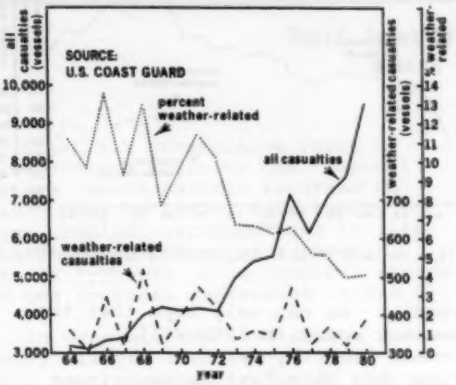


Figure 12.-- Numbers of maritime casualties, 1964-1980 (Source: U.S. Coast Guard).

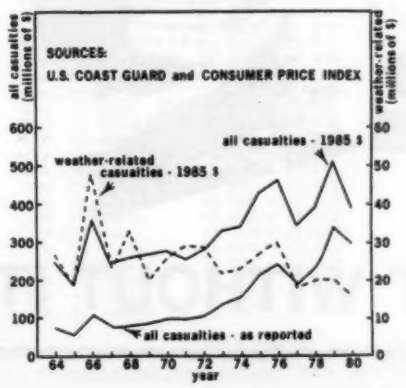

all casualties (millions of $)
SOURCES:
U.S. COAST GUARD and CONSUMER PRICE INDEX
weather-related (millions of $)
all casualties - 1985 $
weather-related casualties - 1985 $
all casualties - as reported
year

Figure 13.-- Dollar losses from maritime casualties, 1964-1980 (Source: U.S. Coast Guard).

On a global basis, figure 14 shows the average number of maritime casualties per day for a 10-year period, 1964-1973, as reported monthly by the Liverpool Underwriters Association in their Casualty Returns. These reports are also published in Lloyd's List and are compiled for important casualties involving ships of 500 gross tons or more. Since 1974 the Casualty Returns have summarized only total losses, so the averaging period stopped with 1973 data. Whereas weather-related losses appear to average about two per day, the seasonal amplitude of so-called nonweather-related casualties implies that another three or four per day are seasonally induced and probably have weather as a contributing factor. The reversal of seasons in the Southern Hemisphere would dampen this influence, but most shipping is in the Northern Hemisphere, and that influence is negligible.

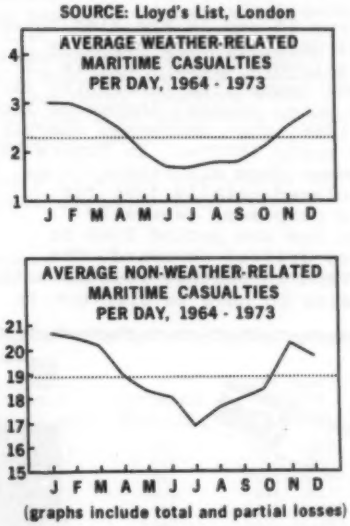

SOURCE: Lloyd's List, London
AVERAGE WEATHER-RELATED MARITIME CASUALTIES PER DAY, 1964 - 1973
J F M A M J J A S O N D
AVERAGE NON-WEATHER-RELATED MARITIME CASUALTIES PER DAY, 1964 - 1973
J F M A M J J A S O N D
(graphs include total and partial losses)

Figure 14.-- Maritime losses per day, plotted monthly (Source: Liverpool Underwriters Association, Casualty Returns, as reported in Lloyd's List).

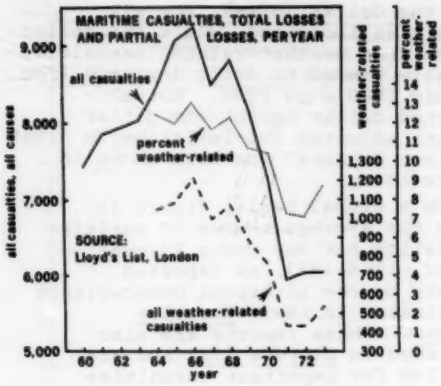


Figure 15.-- Maritime losses, yearly totals, 1960-1972.

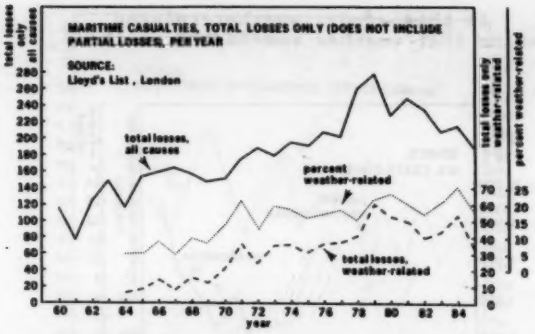


Figure 16.-- Maritime Total Losses, yearly totals, 1960-1985.

Figures 15 and 16 are also based on global data from the Casualty Returns (Lloyd's List). Figure 15 shows that casualties (including partial and total losses) increased from 1960 to 1966, then decreased sharply into the early 1970's. In Figure 16, total losses from all causes, i.e., ships declared totally lost for insurance purposes, generally increased for the period 1960 to 1979, then drifted downward. The upward trend in weather-related total losses seems to have leveled out in the 1980's. We can only hope that the improvement noted in 1985 will continue.

From this multifarious assortment of summaries it can been that the percentages of casualties that are weather-related are probably underreported. Overall this type of casualty appears to have decreased between 1964 and 1980 in U.S. waters, while worldwide the trend has been upward from 1960 to 1985, with some leveling off in the 1980's. All this has been taking place while marine casualties, as a whole, are on the rise. □

☆ DON'T LEAVE PORT WITHOUT IT ☆

WESTERN NORTH PACIFIC TYPHOONS, 1985

Staff, Joint Typhoon Warning Center
Guam, Mariana Islands

After six consecutive years of below average activity the tropical western North Pacific returned to near normal in 1985. Some twenty seven tropical cyclones came to life; this included one super typhoon, sixteen typhoons, nine tropical storms and one tropical depression (table 2).

In general, the 1985 season can be neatly divided into two periods: the early part, January to August and the late, September to December (fig. 17). The early season composite best tracks show that the overwhelming majority of the tropical cyclones during the period recurved. A major shift in tropical cyclone activity occurred during the second part of the year. Only two tropical cyclones recurved. Where, Japan and Korea received the brunt of the tropical cyclone activity the first half of the year, it was the Philippines and Vietnam which suffered most during the second.

In the western North Pacific, tropical cyclones reaching tropical storm intensity, or greater, are assigned names in alphabetical order from a list of alternating male/female names. Each tropical cyclone's maximum surface wind and minimum sea-level pressure were obtained from best estimates based on all available data.

Figure 17 shows the tracks of the individual cyclones from first

Table 1.-- Summary of the 1985 season.

WESTERN NORTH PACIFIC

1985 SIGNIFICANT TROPICAL CYCLONES

TROPICAL CYCLONE	PERIOD OF WARNING	CALENDAR DAYS OF WARNING	NUMBER OF WARNINGS ISSUED	MAXIMUM SURFACE WINDS-KT (M/S)	ESTIMATED MSLP- MB	BEST TRACK DISTANCE TRAVELED-NM (KM)
01W TS ELSIE	07 JAN - 09 JAN	3	9	40 (21)	995	976 (1808)
02W TS FABIAN	09 JAN - 13 JAN	5	16	55 (28)	989	507 (939)
03W TY GAY	21 MAY - 26 MAY	6	22	100 (51)	951	1464 (2711)
04W TD 04W	18 JUN - 20 JUN	3	10	30 (15)	992	441 (817)
05W TY HAL	19 JUN - 25 JUN	6	22	100 (51)	942	1305 (2417)
06W TY IRMA	25 JUN - 01 JUL	7	27	90 (46)	957	2413 (4469)
07W TY JEFF	22 JUL - 02 AUG	12	43	75 (39)	967	2668 (4941)
08W TY KIT	03 AUG - 11 AUG	9	33	85 (44)	959	1953 (3617)
09W TS LEE	11 AUG - 14 AUG	4	15	60 (31)	985	1326 (2456)
10W TY MAMIE	16 AUG - 20 AUG	5	17	70 (36)	975	1335 (2472)
11W TY NELSON	17 AUG - 24 AUG	8	27	95 (49)	961	1651 (3058)
12W TY ODESSA	23 AUG - 01 SEP	10	39	90 (46)	957	2328 (4311)
13W TY PAT	27 AUG - 01 SEP	6	23	95 (49)	961	1337 (2476)
14W TS RUBY	28 AUG - 01 SEP	5	19	55 (28)	982	1310 (2426)
02C TY SKIP	30 AUG - 08 SEP	10	34	80 (41)	974	1822 (3374)
15W TY TESS	01 SEP - 06 SEP	7	22	75 (39)	967	1470 (2722)
16W TS VAL	15 SEP - 18 SEP	4	14	50 (26)	992	1630 (3019)
17W TS WINONA	19 SEP - 22 SEP	4	11	50 (26)	990	518 (959)
18W TY ANDY	28 SEP - 02 OCT	5	16	70 (36)	970	705 (1306)
19W TY BRENDA	29 SEP - 05 OCT	7	25	90 (46)	964	1551 (2872)
20W TY CECIL	12 OCT - 16 OCT	5	16	100 (51)	944	1034 (1915)
21W STY DOT	13 OCT - 22 OCT	10	34	150 (77)	897	3074 (5693)
22W TY ELLIS	16 OCT - 20 OCT	5	19	50 (26)	995	1046 (1937)
23W TY FAYE	23 OCT - 01 NOV	10	39	100 (51)	960	1849 (3424)
24W TS GORDON	20 NOV - 26 NOV	7	23	45 (23)	997	797 (1476)
25W TY HOPE	17 DEC - 24 DEC	8	26	100 (51)	948	1444 (2674)
26W TS IRVING	18 DEC - 21 DEC	4	14	60 (31)	994	806 (1493)
	1985 TOTALS:	127*	715			

* OVERLAPPING DAYS INCLUDED ONLY ONCE IN SUM.

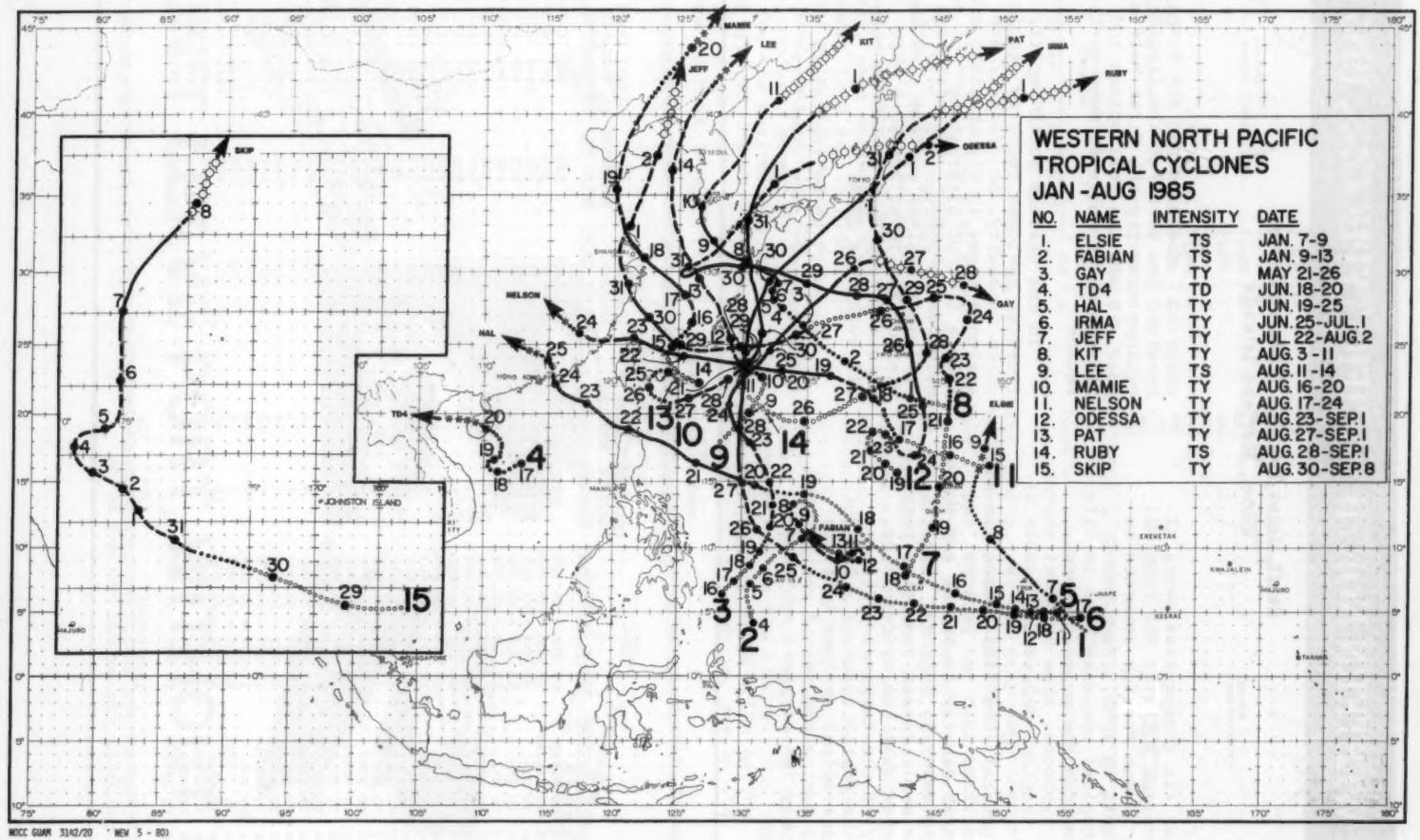
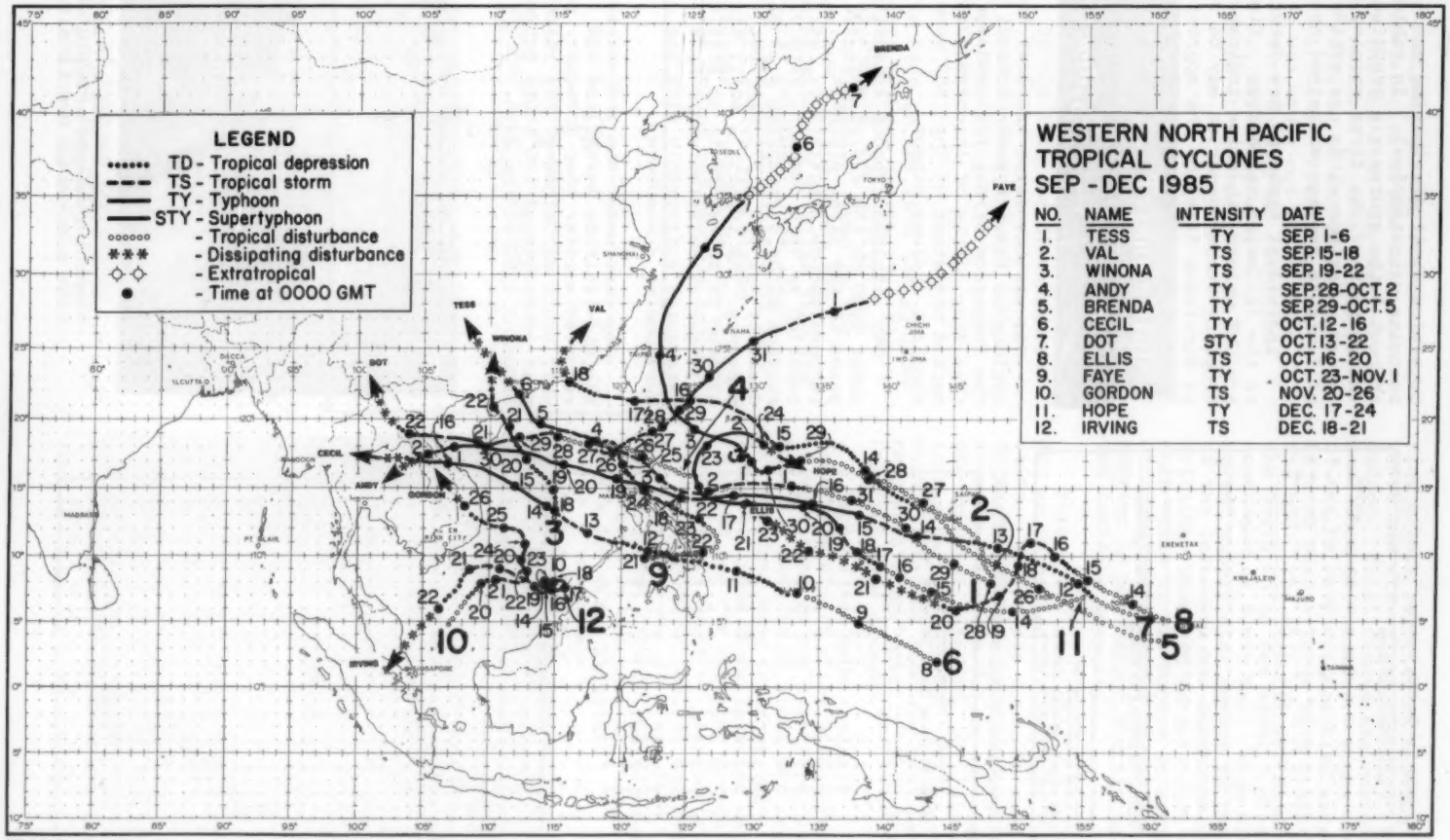

WESTERN NORTH PACIFIC
TROPICAL CYCLONES
JAN - AUG 1985
NO. NAME INTENSITY DATE
1. ELSIE TS JAN. 7-9
2. FABIAN TS JAN. 9-13
3. GAY TY MAY 21-26
4. TD4 TD JUN. 18-20
5. HAL TY JUN. 19-25
6. IRMA TY JUN. 25-JUL. 1
7. JEFF TY JUL. 22-AUG. 2
8. KIT TY AUG. 3-11
9. LEE TS AUG. 11-14
10. MAMIE TY AUG. 16-20
11. NELSON TY AUG. 17-24
12. ODESSA TY AUG. 23-SEP. 1
13. PAT TY AUG. 27-SEP. 1
14. RUBY TS AUG. 28-SEP. 1
15. SKIP TY AUG. 30-SEP. 8
MAMIE
LEE
KIT
PAT
IRMA
RUBY
JEFF
ODESSA
NELSON
HAL
GAY
TD4
ELSIE
FABIAN
SKIP
JOHNSTON ISLAND
MAJURO
EREVETAK
KWAJALEIN
KOROR
TARAWA
JAKARTA
SINGAPORE
MANILA
HONG KONG
TOKYO
SEOUL
SHANGHAI
JAPAN
MOCC GUAM 31A2/20 NOV 5 - 80)

Figure 17A



NOCC GUAM 3142/20 (REV 5 - 80)

Figure 17B

Table 3.-- Monthly summary.

1985 SIGNIFICANT TROPICAL CYCLONES

WESTERN NORTH PACIFIC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	(1959-1985) AVERAGE	CASES
TROPICAL DEPRESSIONS	0	0	0	0	0	1	0	0	0	0	0	0	1	3.9	99
TROPICAL STORMS	3	0	0	0	0	0	0	0	3	3	1	1	1	9	9.9	252
TYPHOONS	0	0	0	0	1	2	1	1	3	4	0	1	13	17.3	440
ALL TROPICAL CYCLONES	3	0	0	0	1	3	1	1	5	5	1	2	23	30.9	835
1959 - 1985 AVERAGE	.6	.3	.7	.8	1.3	2.0	4.7	6.3	5.7	4.6	2.6	1.4	30.9		
CASES	15	8	18	21	34	54	120	170	153	124	71	38	835		

FORMATION ALERTS: 26 of 29 Formation Alerts developed into significant tropical cyclones. Tropical Cyclone Formation Alerts were issued for all except one of the significant tropical cyclones that developed in 1985.

WARNINGS:
- Number of calendar warning days: 127
- Number of calendar warning days with two tropical cyclones in region: 33
- Number of calendar warning days with three or more tropical cyclones in region: 4

Table 4.-- Typhoon frequencies compared with past years.

FREQUENCY OF TYPHOONS BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
(1945-1958) AVERAGE	.4	.1	.3	.4	.7	1.1	2.0	2.9	3.2	2.4	2.0	.9	16.3
1959	0	0	0	1	0	0	1	5	3	3	3	2	17
1960	0	0	0	1	0	2	2	8	0	4	1	1	19
1961	0	0	1	0	2	1	3	7	5	1	1	1	22
1962	0	0	0	1	0	0	1	5	3	4	3	0	14
1963	0	0	0	1	1	3	3	3	3	4	0	2	19
1964	0	0	0	0	3	3	6	3	5	3	4	1	34
1965	1	0	0	1	2	2	4	3	5	2	1	0	21
1966	0	0	0	1	2	1	3	4	4	2	0	1	20
1967	0	0	1	1	0	1	3	4	4	1	1	0	16
1968	0	0	0	1	1	1	1	4	3	5	1	0	17
1969	1	0	0	0	0	2	3	3	3	1	0	0	13
1970	0	1	0	0	0	1	0	4	2	3	1	0	12
1971	0	0	0	1	1	2	6	3	3	3	1	0	20
1972	1	0	0	0	1	1	4	4	3	4	2	2	22
1973	0	0	0	0	0	0	1	2	3	3	0	0	9
1974	0	0	0	0	1	2	1	2	3	4	2	0	15
1975	1	0	0	0	0	0	1	3	4	3	2	0	14
1976	1	0	0	1	2	2	2	1	4	1	1	0	15
1977	0	0	0	0	0	0	3	0	2	3	2	1	11
1978	0	0	0	1	0	0	0	2	0	2	0	0	5
1979	1	0	1	1	0	0	2	2	3	2	1	1	14
1980	0	0	0	0	2	0	3	2	3	2	1	0	15
1981	0	0	1	0	0	2	2	2	4	1	2	2	16
1982	0	0	0	0	1	1	2	5	3	2	1	1	16
1983	0	0	0	0	0	0	3	2	1	4	2	0	12
1984	0	0	0	0	0	0	4	2	1	5	3	1	16
1985	0	0	0	0	1	2	1	5	3	4	0	1	17
(1959 - 1985) AVERAGE	.2	.04	.2	.6	.8	.9	2.7	3.3	3.1	3.1	1.6	.6	17.1
CASES	6	1	6	15	21	25	74	90	85	85	43	17	469

Table 5.-- Tropical Cyclone frequencies compared with past years.

FREQUENCY OF TROPICAL STORMS AND TYPHOONS BY MONTH AND YEAR

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
(1945-1958) AVERAGE	.4	.1	.4	.5	.8	1.3	3.0	3.9	4.1	3.3	2.7	1.1	21.6
1959	0	1	1	1	0	0	3	6	6	4	2	2	26
1960	0	0	0	1	1	3	3	10	3	4	1	1	27
1961	1	1	1	1	3	2	5	4	6	5	1	1	31
1962	0	1	0	1	2	0	6	7	2	5	2	3	30
1963	0	0	0	1	1	3	4	3	5	5	0	3	25
1964	0	0	0	0	3	2	7	9	7	6	6	1	40
1965	2	2	1	1	2	3	5	6	7	3	2	1	34
1966	0	0	0	1	2	1	5	8	7	3	3	1	30
1967	1	0	2	1	1	1	6	8	7	4	3	1	35
1968	0	0	0	1	1	1	3	8	3	6	4	0	27
1969	1	0	1	1	0	0	3	4	3	3	2	1	19
1970	0	1	0	0	0	2	2	4	4	5	1	0	24
1971	1	0	0	1	1	2	8	4	4	3	1	0	25
1972	1	0	0	0	1	3	6	5	4	5	2	3	30
1973	0	0	0	0	0	0	1	5	2	4	3	0	15
1974	0	0	0	1	1	4	3	5	3	4	3	0	25
1975	1	0	0	0	0	0	2	4	5	5	3	0	20
1976	1	1	0	2	2	2	4	4	5	1	1	2	25
1977	0	0	1	0	0	1	4	1	5	4	3	1	19
1978	1	0	1	0	0	3	4	7	5	4	2	0	28
1979	1	0	1	1	1	0	4	2	7	3	2	2	24
1980	0	0	0	1	4	1	4	3	6	4	1	1	24
1981	0	0	1	2	0	2	5	7	4	2	2	2	26
1982	0	0	0	0	1	3	4	5	3	3	1	1	24
1983	0	0	0	0	0	0	3	5	2	5	3	1	23
1984	0	0	0	0	0	2	5	5	4	7	3	1	27
1985	2	0	0	0	1	2	1	7	5	5	1	2	26
(1959-1985) AVERAGE	.5	.3	.5	.8	1.1	1.6	4.3	5.4	4.9	4.1	2.4	1.2	27.3
CASES	14	7	14	21	30	44	117	147	131	112	66	33	736

detection until dissipation or becoming extratropical. In tables 2 through 5 the storms are credited to the month that the first warning was issued. Maximum winds are estimates of 1-minute average sustained speeds.

Individual typhoons are described in the following narratives. Times are GMT unless otherwise indicated. Tropical storm summaries may be found in Hurricane Alley of the appropriate issue of the Mariners Weather Log.

. . . Typhoon Gay

Gay was the first tropical cyclone to reach typhoon intensity. The formation of Gay followed more than four months of inactivity and marked the start of the 1985 summer tropical cyclone season.

Gay attained typhoon intensity at about 0000 on the 23d of May just prior to the first aircraft reconnaissance penetration. Gay was reported as very compact, with 65-knot surface winds surrounding a 15-mile diameter eye and a 971-millibar pressure. The typhoon's small size allowed it to mature in an area where a larger circulation would have interacted unfavorably with the surrounding atmosphere.

Gay came under the influence of the mid-latitude westerlies and recurved earlier than forecast, passing well south of Okinawa. Gay reached a peak intensity of 100 knots between 0600 and 1200 on the 24th.

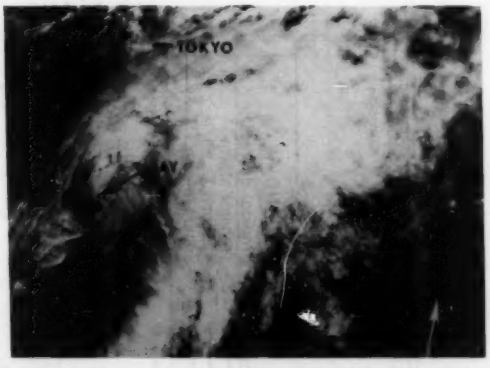


Figure 18.-- As Gay completes extratropical transition, the upper level westerlies are shearing convection away to the northeast at 0413 on the 26th.

After recurvature, Gay started a gradual acceleration to the northeast. By 0600 on the the 25th, Gay was entraining modified polar air into the low-level circulation and the eyewall was disintegrating. Extratropical transition had begun and the intense central convection started displacing outward. Gay was downgraded to a tropical storm at 0000 on the 26th (fig. 18).

. . . Typhoon Hal

Hal was first detected as a weak tropical disturbance at 05°N, 154°E on June 11. By the 18th the disturbance had merged with the strong low-level southwest monsoon flow and had taken on the characteristics of a monsoon trough disturbance.

By the 0600 on the 20th the cyclone had reached typhoon intensity. Figure 19 shows a plot of the aircraft reconnaissance mission flown at the time. Maximum surface winds are located approximately 90 miles from the center of the cyclone. This large separation is a characteristic of many cyclones that evolve from strong monsoon troughs. Typhoon Hal continued intensifying during the next 24 hours.

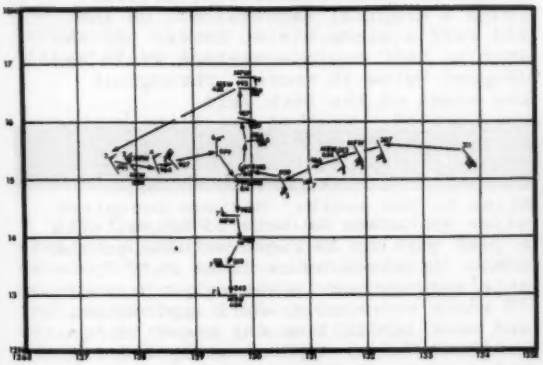


Figure 19.-- Plot of aircraft reconnaissance data from 0500 on the 20th to 0100 on the 21st. This shows Hal's maximum surface winds located approximately 90 miles from the cyclone center. "MFW" is the maximum observed flight level winds and "MSW" is the maximum surface wind observed.

The Philippine island of Luzon experienced the strongest effects as the center of typhoon Hal passed westward through the Luzon Straits. The death toll was 23 persons with nine others reported as missing. There was widespread flooding and crop damage. Total damage was estimated at more than $10 million. Eight crewman of the US Navy frigate KIRK were injured when a large wave crashed over the bow. The ship was operating in the South China Sea about 5 miles southwest of Subic Bay. High winds caused superficial damage to the hull of the destroyer USS OLDENDORF when a drifting, unmanned barge struck the ship while it was moored at Subic Bay. Strong winds tore the barge from its mooring in mid-harbor shortly before the incident occurred.

Taiwan was also affected by typhoon Hal as it caused strong winds and heavy rains. Two people died, 18 were injured, and five people were listed as missing. Eastern Taiwan experienced the heaviest rainfall, with almost 9 inches being reported. The heavy rainfall caused flooding that was responsible for most of the deaths, injuries, and damages.

Typhoon Hal made landfall approximately 75 miles east northeast of Hong Kong on the 24th (fig. 20) at 0500. A gust to 50 knots was recorded at the Hong Kong International Airport. Some minor injuries were reported and the property damage was slight. All modes of transportation were disrupted on the 23d and 24th. Heavy rain on the 25th and 26th, after Hal had moved inland, caused numerous landslides in the Hong Kong area with only a few minor injuries.

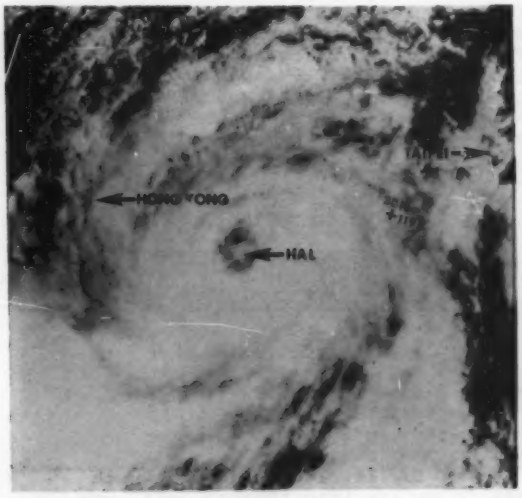


Figure 20.-- Typhoon Hal at 0559 on the 23d.

. . . Typhoon Irma

Although Irma was not one of the more intense systems of the year, it became noteworthy due to the magnitude of property damage and loss of life it caused in the Philippines; and later, by passing directly over the Tokyo metropolitan area.

Typhoon Irma was slow to develop, taking eight days to become a tropical storm. The first warning on the system was issued at 0143 on June 25th. Aircraft reconnaissance later in the day located a 994-millibar circulation center with 45-knot winds 90 miles east northeast of the center.

Early on the 27th, Irma attained typhoon intensity as verified by ship observations of 65 knots northeast of the center. Irma reached a maximum intensity of 90 knots with a pressure of 957 millibars at 0000 on the 29th. Within 24 hours, Irma headed for Tokyo. Simultaneously, the system began weakening and undergoing extratropical transition.

As the typhoon passed east of the Philippines on the 28th and 29th, heavy rains across the island of Luzon, totaled more than 28 inches. Flooding was widespread across areas of Manila and other sections of Luzon. At least 46 people perished in these floods; additionally, over 1,500 lost their homes. Later, when Irma made landfall on the southeastern tip of Honshu, the Naval Oceanography Command Facility at Yokosuka reported maximum winds of 51 knots with a peak gust to 83 knots. The associated barograph trace is shown in figure 21. Japan police reported three deaths and five people missing as a result of Irma. Twelve bridges were reported out, flood damage occurred to over 20,000 homes and power outages affected about 440,000 households.

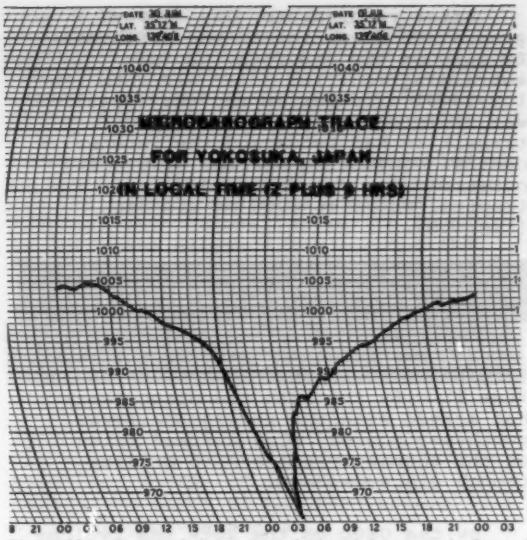


Figure 21.-- Barograph trace from the Naval Oceanography Command Facility in Yokosuka documents Irma's passage over the Kanto Plain. The minimum sea level pressure was 963.3 at 1930 on the 30th.

. . . Typhoon Jeff

Jeff was the longest-lived tropical cyclone of the 1985 season. Jeff, as it turned out, would be the only tropical cyclone to develop during July, a month that normally produces five cyclones.

The low-level circulation which was to mature into typhoon Jeff, was spawned south of Guam on 18th. Consolidating slowly, the system drifted northward across the island of Guam and through the northern Marianas, bringing little more than increased rainshower activity. Early on the 22d a reconnaissance aircraft found a tropical depression. On the 23d Jeff's winds hit 60 knots. By the 26th at 0600 maximum surface winds had dropped below 30 knots. Throughout the night of the 26th Jeff regenerated. Weather satellite photos revealed a dramatic increase in central convection. As Jeff neared Okinawa it slowed passing about 75 miles to the south. Maximum sustained winds at Kadena AB were 25 knots, with a peak gust to 39 knots at 0208 on the 28th. Eighteen hours later Jeff attained typhoon intensity. A peak of 75 knots occurred as Jeff approached, and made landfall on the coast of mainland China, approximately 180 miles south of Shanghai (fig. 22). Once onshore, surface frictional effects caused a rapid decrease in maximum winds.

Jeff was not finished yet. At 0000 on 1 August satellite photos indicated increased convection over water. Acceleration was gradual as Jeff redeveloped; maximum surface winds reached 50 knots by 1800. At 0600 on the 2d Jeff was finalled for the third and last time. Eastern China bore the brunt of Jeff. The

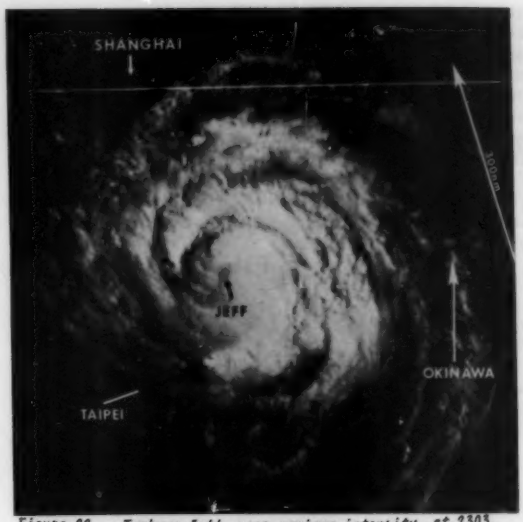


Figure 22.-- Typhoon Jeff, near maximum intensity, at 2303, less than 18 hours from landfall over eastern mainland China.

provinces of Shanghai and coastal Zhejiang were battered. News reports indicated at least 180 people were killed, 1400 injured and tens of thousands left homeless. In addition, 1400 watercraft, mostly fishing boats, were lost or badly damaged. Some 75,000 acres of crops were destroyed and another 400,000 acres badly damaged, by the typhoon. China's irrigation network was severely disrupted by flooding.

. . . Typhoon Kit

On the 31st, north of Guam, an area of disturbed weather was developing at the northeast end of the moonsoon trough. Ship observations indicated that a low-level circualation was present in the disturbed area with winds of 10 to 20 knots .

Tropical depression 08W was upgraded to tropical storm kit at 0000 on August 4th. Kit moved slowly west-northwestward for the next 24 hours, then turned slowly northward through the 6th, while continuing to intensify. Kit attained its maximum intensity of 85 knots at 0600 on the 8th, southwest of Kyushu. After 1200, Kit began to weaken as relatively cooler and drier low-level air was entrained into the vortex's southwest quadrant.

It recurved and was barely at typhoon strength when landfall occurred on the southwest tip of South Korea early on the 10th. Kit still packed quite a punch, however. Torrental rains on the island of Cheju and southern coastal Korea caused extensive property and crop damage. At least ten people were reported missing or killed. Additionally a Department of Defense communciations site in the area received an estimated $1.5 million damage. With extratropical transition in progress, Kit rapidly lost strength while accelerating northeastward into the Sea of Japan.

. . . Typhoon Mamie

Despite reaching a maximum intensity of only 70 knots, Mamie was one of the more desructive tropical cyclones of the 1985 season. Mamie was responsible for least 35 deaths and caused heavy damage to crops, homes, and shipping. For 2 August days Mamie skirted a 400 mile stretch of the eastern Chinese coast from Shanghai to the Shantung Peninsula, inundating farmland and washing away many dikes and dams with its torrential rains. Estimates of the destruction caused by Mamie were staggering: over 6.5 million trees uprooted, 2.9 million metric tons of high stalk farm crops ruined, more than 120,000 houses destroyed or damaged, 200 watercraft of various types sunk or driven aground, and over 122,000 domestic livestock drowned.

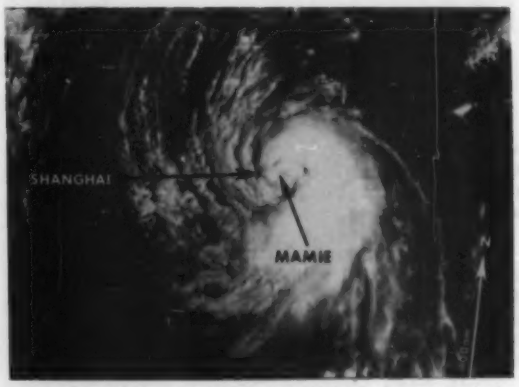


Figure 23.-- Mamie, sporting typhoon force winds, passes just east of Shanghai at 0149 on the 18th.

Mamie formed from an area of convection. Satellite imagery, late on the 14th, showed the disturbance was turning to the north and becoming more organized as the separation from Lee's wind field increased. Mamie reached typhoon intensity at about 0000 on the 17th. The typhoon reached a peak intensity of 70 knots 12 hours later, just prior to affecting the Chinese coast near Shanghai (fig. 23). Mamie traversed the Chinese coastline, hitting Tsingtao, with decreased winds of 50 knots at about 0200 on the 19th. Mamie then crossed the Shantung Peninsula, striking Yanti, China at about 0600. Mamie accelerated to 20 knots and weakened to a 40-knot tropical storm just prior to crossing the Yellow Sea and moving toward Dairen, China, After making landfall just west of Dairen, Mamie began to dissipate over land.

. . . Typhoon Nelson

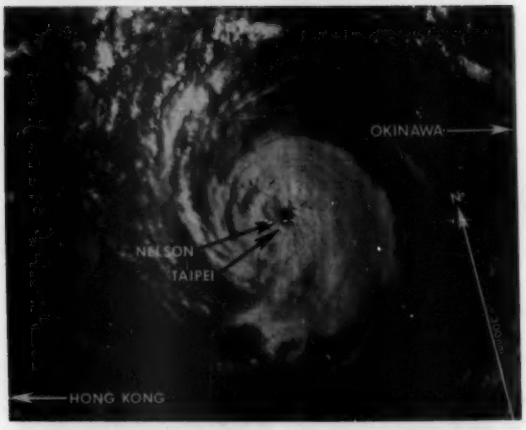


Figure 24.-- Nelson skirting the island of Taiwan at 2334 on the 22d.

Nelson caused substantial damage and loss of life as it passed through the southern Ryukyu Islands, brushed by northern Taiwan and crossed into mainland China during August.

On the 15th the disturbance that developed into typhoon Nelson was first noticed as a small, but persistent, area of poorly organized convection 150 miles east northeast of Saipan in the Marianas.

It wasn't until the 17th that a dramatic increase in both the cyclonic curvature and amount of central convection occurred. Aircraft reconnaissance at 2131 found a band of 45-knot low-level winds some 90 miles to the north northwest of the center. Further intensification occurred as Nelson assumed a more west northwesterly track. At 0000 on the 19th, Nelson was upgraded to a typhoon. Almost three days later, at 1800 on the 21st, Nelson reached a peak intensity of 95 knots with a pressure of 961 millibars.

Early on the 23d (fig. 24), the typhoon skirted northern Taiwan passing within 25 miles of Taipei. The tropical cyclone quickly transited the Formosa Strait and made landfall 40 miles southwest of Fuchou in China's Fuchien province at 1400 on the 24th.

Nelson's passage between Yaeyama and Miyako Islands resulted in more than $1.5 million in damage to banana and sugar cane crops. As Nelson skirted northern Taiwan, four people were reported killed from the associated winds and torrential rains. At landfall in China's Fuchien province, another forty-eight people perished, with an additional 329 reported injured, more than 5,000 homes destroyed, 969 fishing boats sunk and about 178,500 acres of crops lost.

. . . Typhoon Odessa

Post analyses revealed the Odessa reached tropical storm intensity shortly before 1800 on the 23d of August. Odessa matured and assumed a north northwesterly track. Aircraft reconnaissance at 2340 on the 24th reported typhoon winds and a circular eye 15 miles in diameter. Odessa remained a compact typhoon for six days. It's north northwesterly movement slowed as it approached the subtropical ridge axis.

Odessa, executed an abrupt turn to the northeast, accelerated into the Sea of Japan and began extratropical transition (fig. 25). Fortunately the system was compact and weakening or damage might have been more widespread. In Kyushu and other southern islands of Japan, strong rains and winds from Odessa knocked out power and caused fishing vessels to capsize. Ships remained in port at Sasebo, Japan as Odessa passed 60 miles to the north. The final warning was issued as the extratropical remains of Odessa approached northern Honshu.

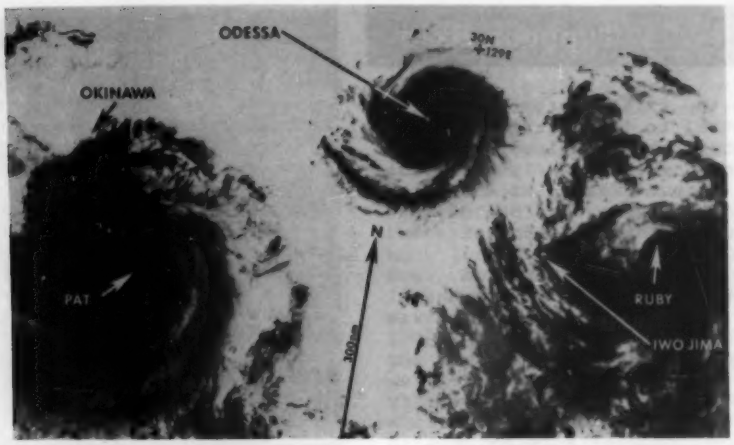


Figure 25.-- Odessa brought to you in infrared at 1024 on the 28th.

. . . Typhoon Pat

Pat developed east of Taiwan, in August, a few days after typhoon Odessa and one day before tropical storm Ruby. Pat was significant due to damage it inflicted in Japan. The disturbance which eventually evolved into Pat, originated in the wake of typhoon Nelson as it moved into eastern China. Early on the 27th Pat was already at tropical storm intensity. For the rest of the 27th and all of the 28th, Pat continued drifting to the northeast, accompanied by Odessa and Ruby. Despite the three cyclones being so close, each was moving a different direction (fig. 26).

Typhoon Pat caused significant damage in southwestern and northeastern Japan; primarly on the islands of Kyushu and Hokkaido. Kyushu was hit the hardest with wind gusts of 107 knots reported at 1940 on the 30th at Kagoshima. A total of 23 people were reported killed with over 180 people injured. An estimated 3,000 homes were damaged and 148 watercraft of varying sizes lost. Pat also severely disrupted transportation by land, sea and air.

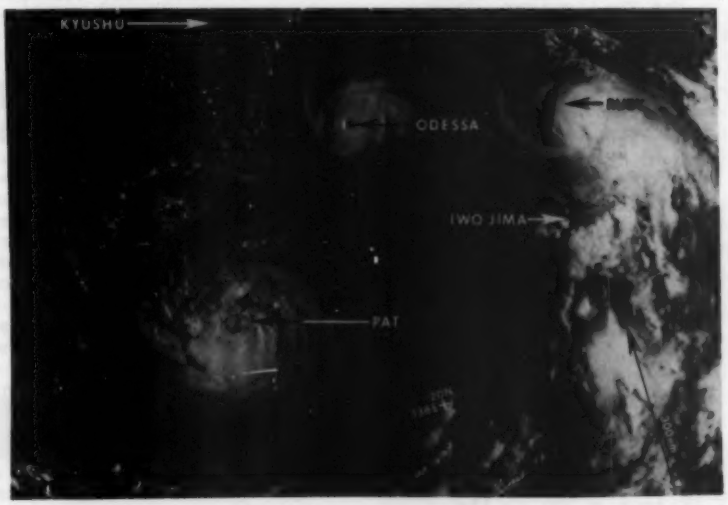


Figure 26.-- Three active tropical cyclones south of Japan and all moving in different directions at 2303 on the 28th.

. . . Typhoon Skip

Skip was the first system to move from the central to the western North Pacific (west of the Dateline) since tropical storm Carmen in early April, 1980. First detected as an area of organized convection on the 28th of August, the disturbance raced west northwestward. On the 30th it had organized and a warning was issued just before it crossed the Dateline.

Coincident with intensification Skip also began to slow. The system obtained typhoon intensity at 1200 on the 1st. A weakening trend set in on the 2d. Finally, late on the 3d, Skip turned away from Wake Island and move toward the north. On the 5th, Skip began to intensify and accelerate. A distinct eye developd as the peak intensity of 80 knots was reached on the 7th. But this peak was short lived, as increased wind shear aloft and interaction with a trailing cold front came into play. Extratropical transition was rapidly completed near the Dateline at 2100 on the 7th.

. . . Typhoon Tess

Tess, originated as a low latitude disturbance, in September, southeast of Guam. Although bringing needed rain to the Philippines, Tess also brought unwanted death and destruction. Four people perished, several were missing and at least 300 were left homeless as this tropical cyclone crossed northern Luzon, disrupting air, ground and sea transportation. In addition, a tornado spawned by Tess, ravaged the coastal town of Lemery, 50 miles south of Manila.

At the 1200 on the 30th of August satellite date indicated that the area of cloudiness, then located 300 miles west of Guam, had shown a marked increase in organization and amount of convection over the previous 12 hours. Tess reached tropical intensity at 0600 on the 1st. Aircraft reconnaissance, on the 2d at 2351, found 65-knot winds and a minimum sea level pressure of 983 millibars. As a result, Tess was further upgraded to typhoon status. As Tess neared Luzon, it took a jog to the northwest sparing the Manila area from the strongest effects of the typhoon.

Landfall weakened Tess; however within 11 hours it was again over water in the South China Sea. Redevelopment to typhoon intensity occurred at 0000 on the 5th. Within 24 hours Tess moved inland over the southern coast of mainland China, 120 miles west-southwest of Hong Kong.

Despite passing well south of the Hong Kong, Tess generated a peak gust to 60 knots at the Royal Observatory, and 65 knots at the Hong Kong International Airport. Although considerable flooding and crop damage occurred over southern China as Tess moved inland, there were no reports of death or injuries.

. . . Typhoon Andy

The disturbance that eventually developed into typhoon Andy was first detected late on the 25th. Coincidently, an early season surge in the northeast monsoon was underway generating 25-to 40-knot winds over the northern South China Sea. Continuing to intensify, Andy attained typhoon strength at 0600 on the 29th. Andy continued across the southern Gulf of Tonkin and reached its maximum intensity of 70 knots at 1800 on the 30th.

Andy made landfall as a minimal strength typhoon approximately 30 miles north of Dong Hoi, Vietnam. The tropical cyclone rapidly weakened as it moved inland.

. . . Typhoon Brenda

The disturbance that would become Brenda was first noticed on September 25th as a large area of persistent convection southeast of Truk. The area tracked northwestward through the 26th. Finally, late on the 28th, the deep convection began to show an increase in amount and organization.

By the 2d, the typhoon had increased in strength and was more circular. Brenda had a unique signature on satellite imagery because of its extremely large eye (fig. 27). The large eye lasted until Brenda moved around a ridge and began to accelerate into the westerlies on the 4th.

During recurvature, Brenda

Figure 27.-- Nighttime enhanced infrared imagery of Brenda's large eye (1407 on the 3d). The eye is 75 miles in diameter.

reached a maximium intensity of 90 knots at 0600 on the 3d, and maintained that intensity for 24 hours. By 0000 an the 5th Brenda began to turn extratropical. These remnants passed through the Korea Strait and into the Sea of Japan later that day.

Known damage from Brenda was limited to the southern Korean Peninsula and adjacent islands. Nearly 12 inches of rain was reported over a large area. The Korean National Disaster Relief Center reported 14 dead, 43 missing, and damage to 167 houses, 630 watercraft and 34,600 acres of rice paddies as a result of the storm's passage.

. . . Typhoon Cecil

Typhoon Cecil began innocently enough as an area of increased convective activity south of the Caroline Islands on the 8th of October. Over the next 72 hours, the tropical distubance tracked to the northwest, passing just south of the Belau (Palau) Islands late on the 9th.

Cecil was already at tropical storm intensity upon emerging into the South China Sea. Cecil steadily intensified and reached typhoon intensity by 1800 on the 13th. It took 3 days to cross the South China Sea. As Cecil passed south of Hainan Island on the 15th, it was at its maximum intensity of 100 knots. By 1200 on the 15th, interaction with the topography of Vietnam and Hainan was preventing further intensification. Cecil made landfall about 40 miles north of Hue. Cecil dissipated over the Laos-Thailand border on the 16th.

Officials in Binh Tri Thien Province in central Vietnam described Typhoon Cecil as "the worst natural disaster yet in central Vietnam ... causing ... damage worth more than 65 million dollars". At least 702 people were confirmed dead with 128 still missing and 560,000 left homeless. In addition to destroying or damaging 200,000 or more homes, Cecil also destroyed about 850 fishing boats and other small vessels.

. . . Super Typhoon Dot

Typhoon Dot was the only super typhoon (intensity equal to or greater than 130 knots) of the 1985 season. Dot was first detected as a tropical disturbance, on the 11th of October. The system reached tropical storm intensity on the 13th, south of Guam.

In a 23-hour period on the 15th Dot's central pressure dropped from 969 to 903 millibars. This exceeds the rate of 2.5 millibars per hour (sustained for at least 12 hours) that has been used to define explosive intensification. Dot reached maxmimum intensity on the 16th, and 17th (fig. 28). Reconnaissance aircraft during this period consistently located the maximum surface winds 5 to 10 miles from the center. Dot was at supertyphoon strength from 16th to the 18th as it approached the Philippines.

In the Philippines seventy-four people were reported killed, more than 50,000 left homeless, and damage to buildings and crops estimated $1.3 million. Clark AB reported maximum

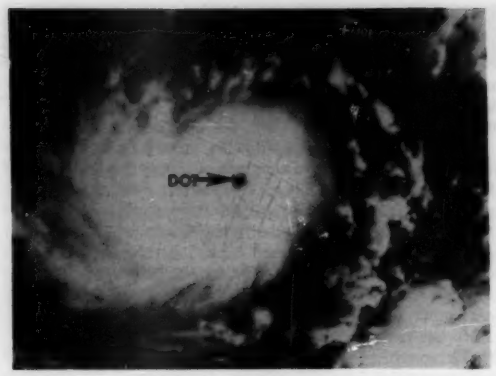


Figure 28.-- Super typhoon Dot at 0147 on the 17th.

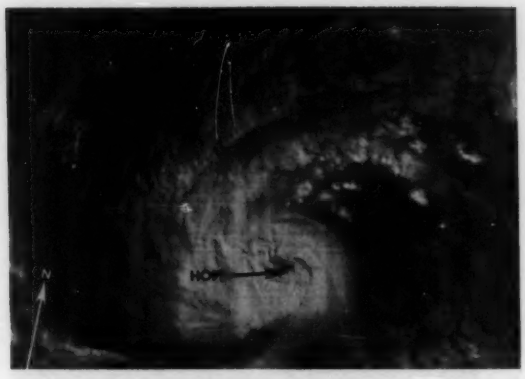


Figure 29.-- Typhoon Hope at 0551 on the 20th.

sustained winds of 27 knots with a peak gust of 44 knots. Dot was a very intense typhoon but the damage done in the Philippines was certainly limited by the storm's small diameter of maximum winds, its small area of intense convection, its path of approach to Luzon (this kept most of the low-level flow parallel to the mountainous terrain, reducing orographically-enhanced rainfall), and the absence of enhanced low-level southwest monson flow.

After entering the South China Sea late on the 18th, with minimal typhoon intensity, Dot reintensified.

By 1200 on the 20th the typhoon peaked at 90 knots, 300 miles south-southwest of Hong Kong. Dot weakened as it churned across the southern tip of Hainan Island, leaving at least two dead, 2300 houses collapsed, and flooding in its wake. Crossing the Gulf of Tonkin in less than a day, it slammed into the coast of North Vietnam 130 miles south of Hanoi.

. . . Typhoon Faye

Faye's formation was unusual because it was masked by two other tropical cyclones already in progress. On the 21st super typhoon Dot was moving from the South China Sea into North Vietnam. To the east in the Philippine Sea were the remnants of tropical storm Ellis.

An aircraft discovered 35-knot winds and a pressure of 1004 millibars, which prompted the first warning on the 23d. It reached tropical storm intensity at 1200. Later tropical storm Faye made landfall over central Luzon 60 miles northeast of Manila with an intensity of 40 knots. Faye tracked across Luzon and entered the South China Sea as a 20-knot tropical depression. During the next 12 hours, Faye reintensified over open water and was upgraded to tropical storm intensity late on the 24th. After completing a small cyclonic loop, Faye turned northeastward and accelerated through the Luzon Strait. The maiximum surface winds were in the northeastern semicircle. For the next two days Faye slowed again, covering only 140 miles. This was accompanied by intensification and Faye became a typhoon at 1800 on the 28th.

After passing south of Okinawa, typhoon Faye decreased in intensity. At 1200 on the 31st, it was downgraded to a tropical storm.

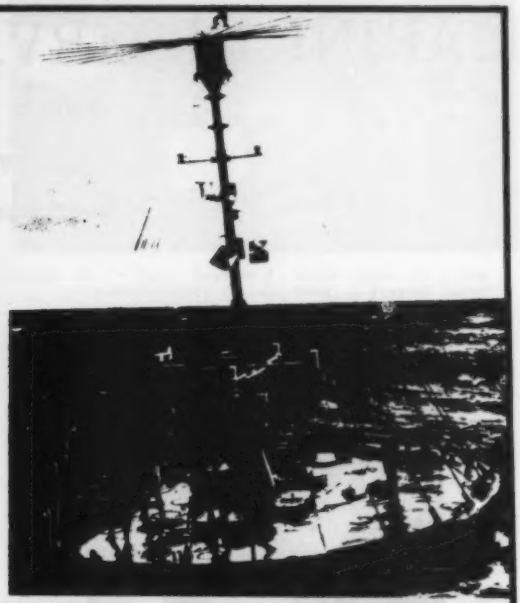
. . . Typhoon Hope

The disturbance, that was to become typhoon Hope, was detected on the 13th of December between Truk and Phonpei. The disturbance moved westerly for the next 3 days and showed signs of slow intensification. By 1800 on the 17th, satellite data indicated the disturbance had further intensified.

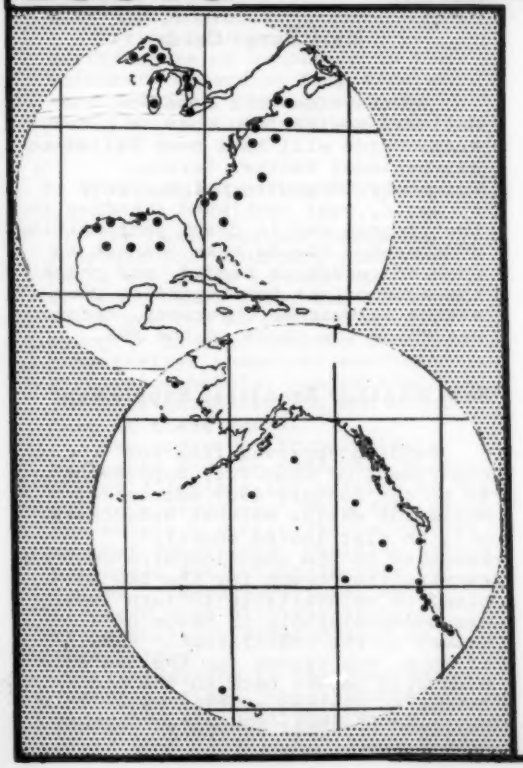
Typhoon Hope reached its maximum intensity of 100 knots at 0600 on the 20th (fig. 29), just 30 hours after the initial warning. After that Hope's intensity decreased slightly and winds remained in the 65-to 75-knot range until the 23d. By this time Hope was recurving before it reached the Philippines. An extratropical transition began on the 24th. There were no deaths, injuries or property damage attributed to this late-season typhoon.□

Steep waves rock, then roll your ship in several directions. Winds reverse themselves with no warning. Sea temperatures drop dramatically in a few miles. A fog engulfs your vessel in a choking blanket: You have just entered--

The COASTAL ZONE.



BUOYS -- WEATHER SENTINELS



Statistics show that weather-related accidents are highest in the coastal zone; the same zone that historically has suffered from a lack of observations due to the demand for attention to navigation. Now this cycle is finally being broken, thanks to Buoys.

Presently more than 40 buoys are taking observations day in and day out throughout the U.S. coastal zone including the Great Lakes and Bering Sea. Some buoys have recorded more than 60 thousand observations of sea temperature, wave heights, windspeeds and more.

SPECIAL OFFER

Now for readers of the **Mariners Weather Log** comes a special, short-time offer. A bound summary of these buoys observations is available free-of-charge, while they last. If you want your own copy ask for:

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MARINE OBSERVATIONS PROGRAM

Martin S. Baron

National Weather Service

Silver Spring, Maryland

On Time Every Time All the Time

Figure 30. -- Mrs. Peggy Dyson says she now feels like a regular on the NOAA team. We are lucky to have her.

Bob Bonner, Offical-in-Charge of the National Weather Service Office in Kodiak, Alaska, prsented a cap and NOAA emblem to Mrs. Peggy Dyson of Kodiak for her outstanding support to NWS in relaying weather observations from the Alaska fishing fleet and keeping the fleet updated with warnings and forecasts issued by the Anchorage forecast office (fig. 30). Mrs Dyson operates station WBH29 on 4125 KHz and makes her radio calls at 8 AM and 6 PM local time, 7 days a week, but is available on an emergency basis around the clock. "On time, every time, all the time" is a phrase used to describe her weather communications. Mrs. Dyson has received numerous awards and honors for her contributions to the safety and productivity of Alaska's fishermen and other mariners. The cap is only a very small token of appreciation form a very large numer of NOAA admirers. BRAVO PEGGY!

Weather Observing Questions

Starting in the fall of 1987, the coast Guard examinations for Ship Masters and Mates will contain questions on weather reporting procedures and the Ship's synoptic code. The monthly exams, given at 19 regional exam centers nationwide, are prepared at the Coast Guard Institute in Oklahoma City. The NWS is providing 300 Ship's Code Cards to the Coast Guard to be used during the exams.

Mail Purge Cards

By the time this issue of the Mariners Weather Log goes to press, Purge Cards will have been mailed to all National Weather Service Voluntary Observing Ships. This is to verify your continued standing in the program and to check your mailing addresses. Please make changes to your addresses as needed, and check the appropriate box regarding your status as Weather Observers, before returning the cards to the NWS.

New Weather Broadcast Supplement

Pending approval from the Department of Commerce, Supplement #3 to the January 1985 edition of Worldwide Marine Weather Broadcasts will be distributed shortly. Response to the questionnaire concerning the format for the new edition, to be available in late 1987, was overwhelmingly in favor of a return to the 1981 format. Because of this, the layout for the new edition will revert back to the old format -- listing station names followed by their scheduled weather broadcasts.

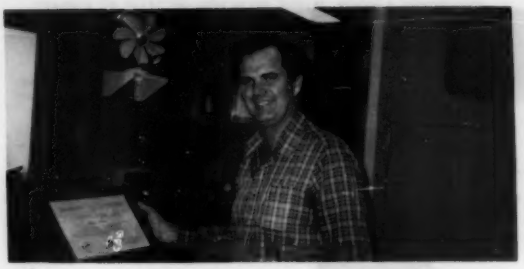


Figure 31. -- Capt. William McAuliffe is skipper of the MOKU-PAHU, a tug operating for Pacific-Gulf Marine.

Figure 32. -- Capt. Raymond F. Dwyer shows off a new certificate for the DAWN, a general cargo carrier of Central Gulf Lines, Inc.

Awards Program

In order to recognize the contributions made by weather observers onboard ship, the National Weather Service is planning an award and recognition program. Awards will be granted to those vessels most closely following the weather reporting schedule, based upon recommendations made by the PMO's. The program will also recognize indivdual merit. We welcome your comments and suggestions concerning this new program.

During October, 160 certificates of memership in the Voluntary Observing Ship Program were prepared, then framed and distributed by the PMO's (figs. 31) and 32).

Weather Reporting Schedule

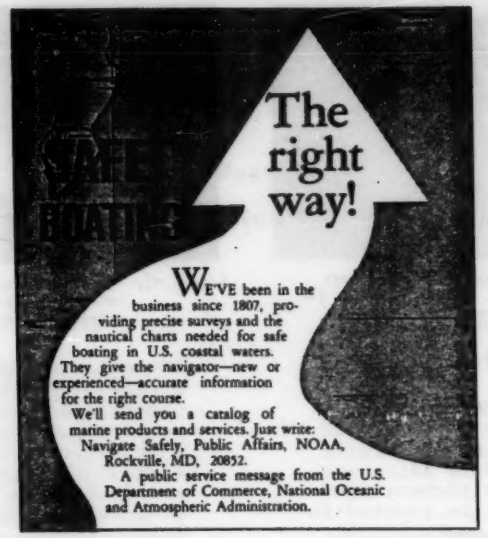
The basic weather reporting schedule for Voluntary Observing Ships worldwide is four times daily, at 0000, 0600, 1200, and 1800 GMT. These are the so called "main synoptic times," because the computerized numerical weather prediction models, generating vital forecast guidance, run and require data at these hours.

The amount of incoming data available for the numerical models directly impacts the quality of the guidance products. More data gives the models a better fix on current weather conditions, yielding better prognoses for meteorologists to follow. Because of this, we strongly urge all vessels to transmit their observations at these times.

In addition to the four main reporting times, observations are requested at least once every 3 hours from vessels operating within 300 miles of named tropical storms or hurricanes. These observations tell the meteorologist about storm intensity, growth, and movement. Without them, the preparation of accurate storm warnings is greatly hindered. Three-hourly observations are also requested from within 200 miles of the coastlines of the United States and Canada, including the Alaska the Great Lakes, and out 200 miles from any of the Hawaiian Islands. Besides reporting at the main synoptic times from these areas, reports are requested at the "Intermediate Standard Times" --0300, 0900, 1500, and 2100 GMT. Coastal waters are data sparse, and large differences in weather conditions often occur between coastal reporting stations and over coastal waters, causing great difficulty for the meteorologist. Data from Voluntary Ships operating in these areas is greatly appreciated by the marine forecasters. Special Reports, designated with the prefix SPREP before the call sign in the weather message, are requested from all areas, whenever you encounter weather significantly worse than forecast.

INMARSAT Procedure Change

In order to speed delivery and reduce manual handling of the Bathythermograph messages sent via INMARSAT, an addition to the reporting procedure is requested. After connecting, please type SOVX, and a carriage return. You should then transmit the BATHY report in the usual manner, beginning with JJXX as the first group in the observation.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A public service message from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration.

tips to the radio officer

Julie L. Houston

National Weather Service

Silver Spring, Maryland

SELECTED WORLDWIDE MARINE WEATHER BROADCASTS (January 1985 Edition)

The January 1985 edition of Selected Worldwide Marine Weather Broadcasts is available from the Superintendent of Documents for $7.50 U.S., Stock number 003-017-00522-4. The address for ordering is:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

WEATHER MESSAGE COMMUNICATIONS REMINDER

SITOR or CW Weather Reports through the U.S. Coast Guard

U.S. Coast Guard radio stations are first priority for receiving weather messages from ships properly equipped. This is because there is no further cost to the government and the messages are immediately available to the AMVER. No address preamble (i.e. OBS METEO WASHDC) is necessary. Start all weather messages with the ship's call sign.

INMARSAT Weather Reports

INMARSAT equipped ships may transmit weather messages using the following procedures after the message is composed off-line:

1. Select U.S. Coast Earth Station Identification Code 01.
2. Select routine priority.
3. Select duplex telex channel.
4. Initiate the call.
   Upon receipt of GA+ (Go Ahead).
5. Select dial code for meteorological reports, 41, followed by the end of selection signal, +.
   41+ (or 00 230 89406+)
6. Upon receipt of our answerback, NWS OBS MHTS, transmit the ships call sign and the weather message only. Do not send any other preamble. Example:
   GA+
   41+
   NWS OBS MHTS
   WLXX 29003 99131 70808 41998 60909 10250 2021/ 40110 52003 71611 85264 22234 00261 20201 31100 40803.....
   The 5 periods indicate the end of the message.
7. Terminate the call with the manual disconnect.

Effective December 1, 1986, the National Weather Service will bill shipping companies for messages that exceed two minutes.

CHANGES TO SELECTED WORLDWIDE MARINE WEATHER BROADCASTS

(January 1985 Edition)

PAGE: 64
DELETE: NMQ Long Beach California and
NMW Astoria, Oregon from the United States Section

PAGE: 66
ADD: Footnote 42. Long Beach Remote
Footnote 43. Astoria Remote

PAGES: 81 - 84
DELETE:
TIME: 0100
PRODUCT: F, W, S
AREA: North Pacific West of 180°
FREQUENCY: 466
SOURCE: NRV, Guam, Mariana Is.

DELETE: The following frequencies for 0300, 1300 and 2200, NPO, San Miguel, Phil.
FREQUENCY: 15925, 1700, 7423.5 and 18321.5

ADD: and following West of 180° in Area Section for 0300, 1300 and 2200, NPO San Miguel, Phil.

DELETE: 466 from frequency Section for 1300, 1700 and 2200, NRV, Guam, Mariana Is. and replace with 8150 and 21760.

REPLACE: Area Section with the following and delete frequency 15925 for 1700, NPO, San Miguel, Phil.
AREA: Equator - 25°N, 130°E-180°, Northwest Pacific Ocean and Indian Ocean.

PAGES: 86-87
REPLACE: Product, Area and Frequency Sections for 0030 NMC, Pt. Reyes, CA, USA with the following:
PRODUCT: W,S,F
AREA: Equator to 30°N east of 140°W and between 30°N and 60°N east of 160°E, Cape St. James to Guadalupe Is., 60 to 250 miles off shore and High Seas North Pacific, 160°E-140°W, Equator to 50°N.
FREQUENCY: 8682, 12730 and 17151.2

ADD:
TIME: 0300
AREA: Point Conception to Mexican Border.
FREQUENCY: 472
SOURCE: NMC, Pt. Reyes, CA, USA
FIG: 19
NOTE: 42

ADD:
TIME: 0400
AREA: Cape St. James to Pt. St. George, 60 to 250 miles off shore.
FREQUENCY: 472
SOURCE: NMC, Pt. Reyes, CA, USA
FIG: 19
NOTE: 42

REPLACE: Area and Frequency Sections for 0500, NMC, Pt. Reyes, CA, USA with the following:
AREA: Cape St. James to Guadalupe Is. 60 to 250 miles off shore.
FREQUENCY: 472

REPLACE: Product and Area Sections for 0630, NMC, Pt. Reyes, CA, USA
PRODUCT: W,S,F
AREA: Point Conception to Mexican Border.

REPLACE: Area and Frequency Sections for 1600, NMC, Pt. Reyes, CA, USA
AREA: Cape St. James to Guadalupe Is., 60 to 250 miles off shore.
FREQUENCY: 472

ADD:
TIME: 1700
AREA: Point Conception to Mexican Border.
FREQUENCY: 472
SOURCE: NMC, Pt. Reyes, CA, USA
FIG: 19
NOTE: 42

TIME: 1830
AREA: Cape St. James to Pt. St. George, 60 to 250 miles off shore.
FREQUENCY: 472
SOURCE: NMC, Pt. Reyes, CA, USA
FIG: 19
NOTE: 43

PAGES: 90 - 92
REPLACE: 0100, NRV, Guam, Mariana Is. with the following:
TIME: 0100
PRODUCT: F, W
AREA: Equator - 25°N, 130°E-180°
FREQUENCY: 466
SOURCE: NRV, Guam, Mariana Is.

REPLACE: 0300, NRV, Guam, Mariana Is. with the following:
TIME: 0300
PRODUCT: F, W
AREA: Equator - 25°N, 130°E-180°, North Pacific Ocean West of 180° and Indian Ocean.
FREQUENCY: 8150 and 21760
SOURCE: NRV, Guam, Mariana Is.

DELETE: 1700, 7423.5, 15925, 18321.5 in Frequency Section for 0300, NPO, San Miguel, Phil.

REPLACE: Area Section and Product Section for 0300, NPO, San Miguel, Phil. with the following:
PRODUCT: F, W
AREA: Equator - 25°N, 130°E-180° North Pacific Ocean West of 180° and Indian Ocean.

REPLACE: 0800, NRV, Guam, Mariana Is. with the following:
TIME: 0800
PRODUCT: F, W
AREA: Equator - 25°N, 130°E-180°.
FREQUENCY: 466
SOURCE: NRV, Guam, Mariana Is.

REPLACE: 1300 NRV Guam Mariana Is. with the following:
TIME: 1300
PRODUCT: W, F
AREA: Equato.-25°N, 130°E-180°, North Pacific West of 180° and Indian Ocean.
FREQUENCY: 8150 and 21760
SOURCE: NRV, Guam, Mariana Is.

DELETE: The following frequencies for 1300 and 2200 NPO, San Miguel, Phil. and add and Indian Ocean following West of 180° in Area Section.
FREQUENCY: 1700, 7423.5 and 15925

REPLACE: 1300, NPN, Guam, Mariana Is. with the following:
TIME: 1300
PRODUCT: F, W
AREA: Equator - 25°N, 130°E-180°, North Pacific West of 180° and Indian Ocean.
FREQUENCY: 8150 and 8710.5
SOURCE: NRV, Guam, Mariana Is.

DELETE: 1700, NRV, Guam, Mariana Is. in its entirety.

REPLACE: 1700, NPN, Guam, Mariana Is. with the following:
TIME: 1700
PRODUCT: F, W
AREA: Equator - 25°N, 130°E-180°, North Pacific Ocean West of 180° and Indian Ocean.
FREQUENCY: 8150 and 21760
SOURCE: NRV, Guam, Mariana Is.

ADD:
TIME: 1700
PRODUCT: F, W
AREA: Equator - 25°N, 130°E-180°, North Pacific Ocean West of 180° and Indian Ocean.
FREQUENCY: 4445, 10440.5, and 12867
SOURCE: NPO, San , Miguel, Phil.

DELETE: 2200, NPN, Guam, Mariana Is. in its entirety.

REPLACE: 2200, NRV, Guam, Mariana Is. with the following:
TIME: 2200
PRODUCT: F, W
AREA: Equator - 25°N, 130°E-180°, North Pacific Ocean West of 180° and Indian Ocean.
FREQUENCY: 8150, 21760
SOURCE: NRV, Guam, Mariana Is.

PAGE: 99
ADD: NMC, Pt. Reyes, California to the United States Section

DELETE: MNW Astoria Oregon from the United States Section

PAGE: 101
DELETE: Footnote 25

PAGES: 123-135
DELETE ENTIRE ENTRY FOR: 0203, 0430, 1030, 1403, 1630, and 2230, NMC, San Francisco, CA, USA

ADD:
TIME: 0203
AREA: Pt. Arena to Pt. Conception, 60 to 250 miles off shore.
FREQUENCY: 2671.4
SOURCE: NMC, Pt. Reyes, CA, USA
FIG: 19

TIME: 0430
PRODUCT: W,S,F
AREA: Equator to 30°N east of 140°W and between 30°N and 60°N east of 160°E, Cape St. James to Guadalupe Is., 60 to 250 miles off shore and High Seas N. Pacific, 160°E-140°W, Equator to 50°N.

FREQUENCY: 4428.7, 8765.4 and 13113.2
SOURCE: NMC, Pt. Reyes, CA, USA
FIG: 19

DELETE ENTIRE ENTRY FOR: 0503, 1433, and 1903, Long Beach, CA, USA
0533 and 1733, NMW, Astoria, OR, USA

ADD:
TIME: 1030
PRODUCT: W,S,F
AREA: Equator to 30°N east of 140°W and between 30°N and 60°N east of 160°E, Cape St. James to Guadalupe Is., 60 to 250 miles off shore and High Seas N. Pacific, 160°E-140°W, Equator to 50°N.Cape St. James to Pt. St. George, 60 to 250 miles
FREQUENCY: 4428.7, 8765.4 and 13113.2
SOURCE: NMC, Pt. Reyes, CA, USA
FIG: 19

TIME: 1403
AREA: Pt. Arena to P. Conception, 60 to 250 miles off shore.
FREQUENCY: 2671
SOURCE: NMC, Pt. Reyes, CA, USA
FIG: 19

TIME: 1630
PRODUCT: W,S,F
AREA: Equator to 30°N east of 140°W and between 30°N and 60°N east of 160°E, Cape St. James to Guadalupe Is., 60 to 250 miles off shore and High Seas N. Pacific, 160°E-140°W, Equator to 50°N.
FREQUENCY: 8765.4, 13113.2 and 17307.3
SOURCE: NMC, Pt. Reyes, CA, USA
FIG: 19

TIME: 2230
PRODUCT: W,S,F
AREA: Equator to 30°N east of 140°W and between 30°N and 60°N east of 160°E, Cape St. James to Guadalupe Is., 60 to 250 miles off shore and High Seas N. Pacific, 160°E-140°W, Equator to 50°N.
FREQUENCY: 8765.4, 13113.2 and 17307.3
SOURCE: NMC, Pt. Reyes, CA, USA
FIG: 19

PAGE: 146
CHANGE: 0000 to 1200 in Explanatory Note 6

ADD: F - Alphanumeric forecast
following EXP - Experimental in Explanatory Note 4

PAGE: 147
ADD: KWX, Lewes, Delaware to the North Atlantic West, United States of America Section following WLO, Mobile Alabama.

PAGE: 149
CHANGE: NMC, San Francisco California to NMC, Pt. Reyes, California

PAGES: 152 - 155
ADD:
TIME: 0645
PRODUCT: P(3-5 day)
AREA: North Atlantic
FREQUENCY: 2614.4 (Winter) and 4223 (Summer)
SOURCE: KWX, Lewes, DE

TIME: 0655
PRODUCT: SST
AREA: North Atlantic
FREQUENCY: 2614.4 (Winter) and 4223 (Summer)
SOURCE: KWX, Lewes, DE

TIME: 0705
PRODUCT: A(00)
AREA: Offshore Waters
FREQUENCY: 2614.4 (Winter) and 4223 (Summer)
SOURCE: KWX, Lewes, DE

TIME: 0717
PRODUCT: P(24)
AREA: Offshore Waters
FREQUENCY: 2614.4 (Winter) and 4223 (Summer)
SOURCE: KWX, Lewes, DE

TIME: 0729
PRODUCT: F(36-48)
AREA: Offshore Waters
FREQUENCY: 2614.4 (Winter) and 4223 (Summer)
SOURCE: KWX, Lewes, DE

TIME: 0739
PRODUCT: A(00)
AREA: North Atlantic
FREQUENCY: 2614.4 (Winter) and 4223 (Summer)
SOURCE: KWX, Lewes, DE

TIME: 0751
PRODUCT: P(36)
AREA: North Atlantic
FREQUENCY: 2614.4 (Winter) and 4223 (Summer)
SOURCE: KWX, Lewes, DE

TIME: 0803
PRODUCT: F(36)
AREA: North Atlantic
FREQUENCY: 2614.4 (Winter) and 4223 (Summer)
SOURCE: KWX, Lewes, DE

ADD:
TIME: 1845
PRODUCT: P(3-5 day)
AREA: North Atlantic
FREQUENCY: 8645.5 (Winter) and 12894 (Summer)
SOURCE: KWX, Lewes, DE

TIME: 1855
PRODUCT: SST
AREA: North Atlantic
FREQUENCY: 8645.5 (Winter) and 12894 (Summer)
SOURCE: KWX, Lewes, DE

TIME: 1905
PRODUCT: A(12)
AREA: Offshore Waters
FREQUENCY: 8645.5 (Winter) and 12894 (Summer)
SOURCE: KWX, Lewes, DE

TIME: 1917
PRODUCT: P(24)
AREA: Mid-Atlantic Coast and Offshore Waters
FREQUENCY: 8645.5 (Winter) and 12894 (Summer)
SOURCE: KWX, Lewes, DE

TIME: 1929
PRODUCT: F(36-48)
AREA: Mid-Atlantic Coast and Offshore Waters
FREQUENCY: 8645.5 (Winter) and 12894 (Summer)
SOURCE: KWX, Lewes, DE

TIME: 1939
PRODUCT: A(12)
AREA: North Atlantic
FREQUENCY: 8645.5 (Winter) and 12894 (Summer)
SOURCE: KWX, Lewes, DE

TIME: 1951
PRODUCT: P(36)
AREA: North Atlantic
FREQUENCY: 8645.5 (Winter) and 12894 (Summer)
SOURCE: KWX, Lewes, DE

TIME: 2003
PRODUCT: F(36)
AREA: North Atlantic
FREQUENCY: 8645.5 (Winter) and 12894 (Summer)
SOURCE: KWX, Lewes, DE

PAGES: 167-172
ADD:
TIME: 0015
PRODUCT: S(96)
AREA: S°N-60°N, 100°E-175°E
FREQUENCY: 4975,7894,10255,15990,19860 and 22910
SOURCE: NPN, Guam, Mariana Is.
NOTE: 16

TIME: 0015
PRODUCT: S(96)
AREA: Western Pacific
FREQUENCY: 22865 and 13395
SOURCE: NPO, Philippines
NOTE: 20

TIME: 0015
PRODUCT: S(96)
AREA: Indian Ocean
FREQUENCY: 4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0015
PRODUCT: S(96)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0015
PRODUCT: S(96)
AREA: Indian Ocean.
FREQUENCY: 17060 and 12673.5
SOURCE: NWC, Harold E. Holt, Australia
NOTE: 20

REPLACE: Product Section for
0030 NPN, Guam Mariana Is.
0030 NPO, San Miguel, Philippines
0030 NKW, Diego Garcia
0030 NDT, Japan
0030 NWC, Harold E. Holt, Australia

PRODUCT: P(24)

REPLACE: Area Section for 0030 and 1230 NPN, Guam Mariana Is.
AREA: 10°S-50°N,100°E-175°E

DELETE ENTRIES: 0040, 0235,0400, 0640, 0645, 0703, 0725, 0735 1055, 1230, 1240, 1255, 1435, 1600, 1840, 1903, 1925, 1935 2225 2240 and 2255 for:
NPN, Guam, Mariana Is.
NPO, San Miguel, Philippines
NKW, Diego Garcia
NDT, Japan
NWC, Harold E. Holt, Australia

ADD:
TIME: 0200,1400
PRODUCT: S(24)
AREA: 10°S-50°N, 100°E-175°E
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guam Mariana Is.
NOTE: 16

TIME: 0200/1400
PRODUCT: S(24)
AREA: Western Pacific
FREQUENCY: 22865 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0200, 1400
PRODUCT: S(24)
AREA: Indian Ocean
FREQUENCY: 15564 and 4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0200, 1400
PRODUCT: S(24)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0200/1400
PRODUCT: S(24)
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

TIME: 0215,1415
PRODUCT: P(24)
AREA: 10°S-50°N, 30°E-105°E
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guam Marina Is.
NOTE: 16

TIME: 0215/1415
PRODUCT: P(24)
AREA: Western Pacific
FREQUENCY: 22865 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

ADD:
TIME: 0215/1415
PRODUCT: P(24)
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0215, 1415
PRODUCT: P(24)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0215/1415
PRODUCT: P(24)
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

TIME: 0300, 1500
PRODUCT: WRNGS
AREA: Western Pacific and Indian Ocean
(Tropical Cyclone Warnings)
FREQUENCY: 4975,7894,10255,15990,19860, and 22910
SOURCE: NPN, Guam, Mariana Is.
NOTE: 16

TIME: 0300/1500
PRODUCT: WRNGS
AREA: Western Pacific
(Tropical Cyclone Warnings)
FREQUENCY: 22865 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0300/1500
PRODUCT: WRNGS
AREA: Indian Ocean
(Tropical Cyclone Warnings)
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0300, 1500
PRODUCT: WRNGS
AREA: Northern Pacific, Sea of Japan
(Tropical Cyclone Warnings)
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

ADD:
TIME: 0300/1500
PRODUCT: WRNGS
AREA: Indian Ocean
(Tropical Cyclone Warnings)
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

TIME: 0315,1515
PRODUCT: P(24)
AREA: 10°S-50°N, 30°E-105°E
FREQUENCY: 4975,7894,10255,15990,19860 and 22910
SOURCE: NPN, Guam, Mariana Is.
NOTE: 16

TIME: 0315/1515
PRODUCT: P(24)
AREA: Western Pacific
FREQUENCY: 22865 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0315, 1515
PRODUCT: P(24)
AREA: Indian Ocean
FREQUENCY: 15564
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0315,1515
PRODUCT: P(24)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0315/1515
PRODUCT: P(24)
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

TIME: 0400, 1600
PRODUCT: S(24)
AREA: 10°S-50°N, 30°E-105°E
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guam, Mariana, Is.
NOTE: 16

ADD:
TIME: 0400/1600
PRODUCT: S(24)
AREA: Western Pacific
FREQUENCY: 22865 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0400/1600
PRODUCT: S(24)
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0400, 1600
PRODUCT: S(24)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0400/1600
PRODUCT: S(24)
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

TIME: 0415/1615
PRODUCT: SA(00)/SA(12)
AREA: 5°N-60°N, 100°E-175°E
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guam, Mariana Is.
NOTE: 16

TIME: 0415/1615
PRODUCT: SA(00)/SA(12)
AREA: Western Pacific
FREQUENCY: 22865 and 13395
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0415/1615
PRODUCT: SA(00)/SA(12)
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

ADD:
TIME: 0415/1615
PRODUCT: SA(00)/SA(12)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0415/1615
PRODUCT: SA(00)/SA(12)
AREA: Indian Ocean
FREQUENCY: 17060, 12673.5/9498.5
SOURCE: NWC, H.E. Holt Australia
NOTE: 20

TIME: 0430,1630
PRODUCT: TYT,EXP,T
AREA: 47°S-63°N, 30°E-175°E (Mon/Thur.)
5°S-60°N, 95°E-180°E (Tue/Fri.) (Wed)
FREQUENCY: 4975, 7894, 10255, 15990, 19860, and 22910
SOURCE: NPN, Guam, Mariana Is.
NOTE: 16

TIME: 0430/1630
PRODUCT: TYT,EXP,T
AREA: Western Pacific
FREQUENCY: 22865 and 1395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0430/1630
PRODUCT: TYT,EXP,T
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0430, 1630
PRODUCT: TYT,EXP,T
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

ADD:
TIME: 0430/1630
PRODUCT: TYT,EXP,T
AREA: Indian Ocean
FREQUENCY: 17060, 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

TIME: 0520/1720
PRODUCT: SA(00)/SA(12)
AREA: 27°S-36°N 30°E-100°E
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guam, Mariana Is.
NOTE: 16

TIME: 0520/1720
PRODUCT: SA(00)/SA(12)
AREA: Western Pacific
FREQUENCY: 22865, 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0520/1720
PRODUCT: SA(00)/SA(12)
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0520/1720
PRODUCT: SA(00)/SA(12)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0520/1720
PRODUCT: SA(00)/SA(12)
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia Mariana Is.
NOTE: 20

TIME: 0535/1735
PRODUCT: SA(00)/SA(12)
AREA: 5°N-60°N, 95°E-180°
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN Guam, Mariana Is.
NOTE: 16

ADD:
TIME: 0535/1735
PRODUCT: SA(00)/SA(12)
AREA: Western Pacific
FREQUENCY: 22865 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0535/1735
PRODUCT: SA(00)/SA(12)
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0535/1735
PRODUCT: SA(00)/SA(12)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0535/1735
PRODUCT: SA(00)/SA(12)
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

TIME: 0555/1755
PRODUCT: SA(00)/SA(12)
AREA: 45°S-63°N, 95°E-180°E
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guam Marina Is.
NOTE: 16

TIME: 0555/1755
PRODUCT: SA(00)/SA(12)
AREA: Western Pacific
FREQUENCY: 22965 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0555/1755
PRODUCT: SA(00)/SA(12)
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

ADD:
TIME: 0555/1755
PRODUCT: SA(00)/SA(12)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0555/1755
PRODUCT: SA(00)/SA(12)
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

TIME: 0615/1815
PRODUCT: WA(00)/WA(12)
AREA: 47°S-63°N, 30°E-180°
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guam Marina Is.
NOTE: 16

TIME: 0615/1815
PRODUCT: WA(00)/WA(12)
AREA: Western Pacific
FREQUENCY: 22865 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0615/1815
PRODUCT: WA(00)/WA(12)
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0615/1815
PRODUCT: WA(00)/WA(12)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0615/1815
PRODUCT: WA(00)/WA(12)
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

ADD:
TIME: 0635, 1835
PRODUCT: W(24)
AREA: 05°N-60°N, 100°E-175°E
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guam Mariana Is.
NOTE: 16

TIME: 0635/1835
PRODUCT: W(24)
AREA: Western Pacific
FREQUENCY: 22865 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0635/1835
PRODUCT: W(24)
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0635, 1835
PRODUCT: W(24)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0635/1835
PRODUCT: W(24)
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

TIME: 0655/1855
PRODUCT: A(00)/A(12)
AREA: 5°N-60°N, 100°E-175°E
FREQUENCY: 4975, 7894, 10255, 15990, 19860, and 22910
SOURCE: NPN, Guam Mariana Is.
NOTE: 20

ADD:
TIME: 0655/1855
PRODUCT: A(00)/A(12)
AREA: Western Pacific
FREQUENCY: 22865 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0655/1855
PRODUCT: A(00)/A(12)
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0655/1855
PRODUCT: A(00)/A(12)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0655/1855
PRODUCT: A(00)/A(12)
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

TIME: 0755, 1955
PRODUCT: S(24)
AREA: 5°N-60°N, 100°E-175°E
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guam Mariana Is.
NOTE: 16

TIME: 0755/1955
PRODUCT: S(24)
AREA: Western Pacific
FREQUENCY: 22865 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0755/1955
PRODUCT: S(24)
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

ADD:
TIME: 0755, 1955
PRODUCT: S(24)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0755/1955
PRODUCT: S(24)
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt Australia
NOTE: 20

TIME: 0810
PRODUCT: S(36)
AREA: 5°N-60°N, 100°E-175°E
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guam Mariana Is.
NOTE: 16

TIME: 0810
PRODUCT: S(36)
AREA: Western Pacific
FREQUENCY: 22865 and 13395
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0810
PRODUCT: S(36)
AREA: Indian Ocean
FREQUENCY: 15564
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0810
PRODUCT: S(36)
AREA: Northern Pacific
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0810
PRODUCT: S(36)
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

ADD:
TIME: 0825/2025
PRODUCT: S(48)/S(36)
AREA: 5°N-60°N, 100°E-175°E
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guam Mariana Is.
NOTE: 16

TIME: 0825/2025
PRODUCT: S(48)/S(36)
AREA: Western Pacific
FREQUENCY: 22865 and 13395
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0825/2025
PRODUCT: S(48)/S(36)
AREA: Indian Ocean
FREQUENCY: 15564,4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0825/2025
PRODUCT: S(48)/S(36)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0825/2025
PRODUCT: S(48)/S(36)
AREA: Inidan Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt Australia
NOTE: 20

TIME: 0855, 2055
PRODUCT: WRNGS
AREA: Western Pacific and Indian Ocean.
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guan, Mariana Is.
NOTE: 16

TIME: 0855/2055
PRODUCT: WRNGS
AREA: Western Pacific
FREQUENCY: 22865 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

ADD:
TIME: 0855/2055
PRODUCT: WRNGS
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0855, 2055
PRODUCT: WRNGS
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0855/2055
PRODUCT: WRNGS
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

TIME: 0905, 2105
PRODUCT: WRNGS
AREA: 5°N-60°N, 100°E-175°E
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guan, Mariana Is.
NOTE: 16

TIME: 0905/2105
PRODUCT: WRNGS
AREA: Western Pacific
FREQUENCY: 22865 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0905/2105
PRODUCT: WRNGS
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0905,2105
PRODUCT: WRNGS
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

ADD:
TIME: 0905/2105
PRODUCT: WRNGS
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

TIME: 0920, 2120
PRODUCT: P(72)
AREA: 5°N-60°N, 100°E-175°E
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guan, Mariana Is.
NOTE: 16

TIME: 0920/2120
PRODUCT: P(72)
AREA: Western Pacific
FREQUENCY: 22865 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 0920/2120
PRODUCT: P(72)
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0920,2120
PRODUCT: P(72)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 0920/2120
PRODUCT: P(72)
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

ADD:
TIME: 0935, 2135
PRODUCT: P(36)
AREA: 5°N-60°N, 100°E-175°E
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guan, Mariana Is.
NOTE: 16

TIME: 0935/2135
PRODUCT: P(36)
AREA: Western Pacific, Sea of Japan
FREQUENCY: 22895 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: G935/2135
PRODUCT: P(36)
AREA: Se of Japan
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 0935, 2135
PRODUCT: P(36)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: nDT, Japan
NOTE: 20

TIME: 0935/2135
PRODUCT: P(36)
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

TIME: 1105/2305
PRODUCT: SA(06)/SA(18)
AREA: 5°N-60°N, 100°E-175°E
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guan, Mariana Is.
NOTE: 16

TIME: 1105/2305
PRODUCT: SA(06)/SA(18)
AREA: Western Pacific
FREQUENCY: 22865 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

ADD:
TIME: 1105/2305
PRODUCT: SA(06)/SA(18)
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 1105/2305
PRODUCT: SA(06)/SA(18)
AREA: Northern Pacific
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 1105/2305
PRODUCT: SA(06)/SA(18)
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

TIME: 1120, 2320
PRODUCT: WRNGS
AREA: 47°S-63°N, 30°E-180°
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guam, Mariana Is.
NOTE: 16

TIME: 1120/2320
PRODUCT: WRNGS
AREA: Western Pacific
FREQUENCY:22965 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 1120/2320
PRODUCT: WRNGS
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 1120, 2320
PRODUCT: WRNGS
AREA: Northern Pacific
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

ADD:
TIME: 1120/2320
PRODUCT: WRNGS
AREA: Indian Ocean
FREQUENCY: 17060 and 12673.5/9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

TIME: 1140, 2340
PRODUCT: WP(36)
AREA: 5°N-60°N, 100°E-175°E
FREQUENCY: 4975, 7894, 10255, 15990, 19860 and 22910
SOURCE: NPN, Guam, Mariana Is.
NOTE: 16

TIME: 1140/2340
PRODUCT: WP(36)
AREA: Western Pacific
FREQUENCY: 22865 and 13395/3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 1140/2340
PRODUCT: WP(36)
AREA: Indian Ocean
FREQUENCY: 15564/4235
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 1140, 2340
PRODUCT: WP(36)
AREA: Northern Pacific, Sea of Japan
FREQUENCY: 12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 1140/2340
PRODUCT: WP(36)
AREA: Indian Ocean.
FREQUENCY: 9498.5/17060 and 12673.5
SOURCE: NWC, H.E., Australia
NOTE: 20

TIME: 1230
PRODUCT: P(24)
AREA: 10°S - 50°N, 100°E - 175°E.
FREQUENCY:4975, 7894, 10255, 15990, 19860, and 22910
SOURCE: NPN, Guam, Mariana Is.
NOTE: 16

ADD:
TIME: 1230
PRODUCT: P(24)
AREA: Western Pacific.
FREQUENCY:3377.5 and 10966
SOURCE: NPO, San Miguel, Philippines
NOTE: 20

TIME: 1230
PRODUCT: P(24)
AREA: Indian Ocean.
FREQUENCY:15564
SOURCE: NKW, Diego Garcia
NOTE: 20

TIME: 1230
PRODUCT: P(24)
AREA: Northern Pacific, Sea of Japan.
FREQUENCY:12777
SOURCE: NDT, Japan
NOTE: 20

TIME: 1230
PRODUCT: P(24)
AREA: Indian Ocean.
FREQUENCY:9498.5
SOURCE: NWC, H.E. Holt, Australia
NOTE: 20

PAGES: 173-178
DELETE ENTIRE ENTRY FOR: 0100, 0103, 0113, 0123, 0300, 0303, 0313, 0333, 0500, 0503, 0513, 0523, 1500, 1503, 1513, 1523, 1715, 1718, 1728, 1738, 1900, 2000, 2003, 2013, 2023, 2330, 2333, 2343 and 2353, NMC San Francisco, CA

ADD:
TIME: 0115
AREA: 30°N to 60°N east of 160°E, 40°N to 52°N, east of 135°W and 28°N to 40°N East of 132°W.
FREQUENCY: 4346.1, 8682, 12730 and 17151.3
SOURCE: NMC, Pt. Reyes, CA, USA

ADD:
TIME: 0300
AREA: 40°N to 52°N, east of 135°W and 28°N to 40°N east of 132°W.
FREQUENCY: 4346.1, 8682, 12730 and 17151.3
SOURCE: NMC, Pt. Reyes, CA, USA

TIME: 0500
AREA: 30°N to 60°N east of 160°E.
FREQUENCY: 4346.1, 8682, 12730 and 17151.3
SOURCE: NMC, Pt. Reyes, CA, USA

TIME: 1500
AREA: 40°N to 52°N, east of 135°W and 28°N to 40°N east of 132°W.
FREQUENCY: 4346.1, 8682, 12730 and 17151.3
SOURCE: NMC, Pt. Reyes, CA, USA

TIME: 1715
AREA: 40°N to 52°N, east of 135°W , 28°N to 40°N east of 132°W, 30°N to 60°N east of 160°E and 20°S to 30°N, east of 160°W.
FREQUENCY: 4346.1, 8682, 12730 and 17151.3
SOURCE: NMC, Pt. Reyes, CA, USA

TIME: 2000
AREA: 30°N to 60°N, east of 160°E.
FREQUENCY: 4346.1, 8682, 12730 and 17151.3
SOURCE: NMC, Pt. Reyes, CA, USA

TIME: 2330
AREA: 20°S to 30°N, east of 160°E and 30°N to 60°N, east of 160°E.
FREQUENCY: 4346.1, 8682, 12730 and 17151.3
SOURCE: NMC, Pt. Reyes, CA, USA

PAGE: 187
DELETE: United States of America
NMC San Francisco, California
under North Pacific West Section

CHANGE: NMC San Francisco, California to NMC Pt. Reyes, California under North Pacific East, United States Section.

PAGE: 193
TIME: 1900
PRODUCT: F,W
AREA: Indian Ocean
FREQUENCY: 8710.5, 13077 and 17203
SOURCE: NRV, Guam, Mariana Is.
NOTE: 8

PAGE: 194
TIME: 1900
PRODUCT: F,W
AREA: Northwest Pacific, equator - 50°N, west of 180° and Indian Ocean
FREQUENCY: 8710.5, 13077 and 17203
SOURCE: NRV, Guam, Mariana Is.
NOTE: 8

DELETE: 0000 NMC, SAN FRANCISCO, CA, USA

PAGE: 195
ADD:
TIME: 0000
PRODUCT: W,S,F
AREA: Equator to 30°N east of 140°W and between 30°N and 60°N east of 160°E, Cape St. James to Guadalupe Is., 60 to 250 miles off shore and North Pacific, 160°E - 140°W, Equator to 50°N.
FREQUENCY: 8714.5 and 17207.0
SOURCE: NMC, Pt. Reyes, CA, USA

TIME: 1800
PRODUCT: W,S,F
AREA: Equator to 30°N east of 140°W and between 30°N and 60°N east of 160°E, Cape St. James to Guadalupe Is., 60 to 250 miles off shore and North Pacific, 160°E - 140°W, Equator to 50°N
FREQUENCY: 8714.5 and 17207.0
SOURCE: NMC, Pt. Reyes, CA, USA

PAGE: 197
DELETE: Frequency 225675 for 1500, NRV Guam, Mariana Is. and replace with the following.
FREQUENCY: 8710.5

TIME: 1900
PRODUCT: W
AREA: Southwest Pacific, equator-50°, West of 180°
FREQUENCY: 13077, 17203 and 8710.5
SOURCE: NRV, Guam, Mariana Is.
NOTE: 8

TIME: 1900
PRODUCT: F,W
AREA: Indian Ocean
FREQUENCY: 8710.5, 13077 and 17203
SOURCE: NRV, Guam, Mariana Is.
NOTE: 8

HURRICANE ALLEY

This column has migrated from the Marine Weather Review back to its original place among our other regular departments. It will be used to bring news and features about tropical cyclones. The review of tropical cyclones for the North Pacific and North Atlantic can be found in the appropriate sections of the Marine Weather Review, right after the descriptions of extratropical cyclones. The worldwide tracks of tropical cyclones will be in the same location in every issue -- the centerfold; its not Playboy but its the best we can do.

The data for the tropical cyclone tracks came from a variety of sources, including Ted Tsui of the Naval Environmental Prediction Research Facility, the Eastern Pacific and National Hurricane Centers, and the Fiji Meteorological Service.

The reason for these changes is mainly to include the contributions from Fiji, Hong Kong and the other tropical meterological services and to give them credit. We will try to provide as much information as we receive. The running tabulations of tropical cyclones for the current year will appear in this column for easy reference.

The first contributions comes from the Fiji Meteorological Service. The following are excerpts from this preliminary report.

Tropical Cyclone Namu May 15-22, 1986

Pradeep Kumar

Fiji Meteorological Service

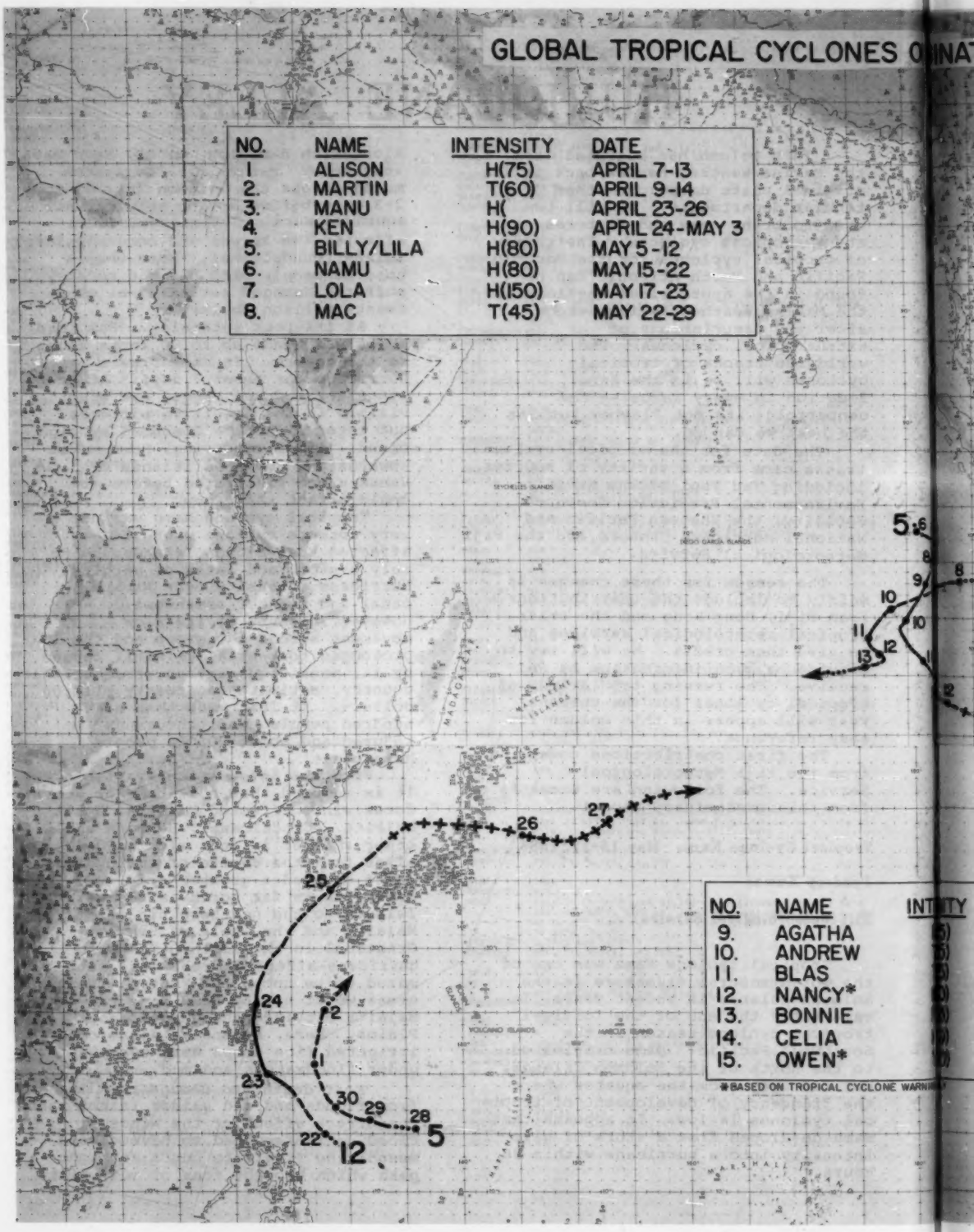
Tropical cyclone Namu was one of the worst natural disasters in the Solomon Islands in recent years. It came after the end of the "offical" tropical cyclone season in the Southwest Pacific. Namu originated to the north of the Solomon Islands, not far away from the equator where the frequency of development of tropical cyclones is low. It appears that Namu developed from a storm of gale intensity into a hurricane within 36 hours. Along with damaging winds, Namu gave very heavy rainfall. The system moved across the Solomon Islands for 2-3 days before moving away farther southwestward. Cyclone Namu most affected the larger and more populated island, Guadalcanal. More than a hundred people died and the country suffered damaged estimated at about twenty million dollars.

At its peak intensity. Namu had sustained winds up to 80 knots close to the centre. It stayed as a hurricane for about 3 days. At one stage a broad and ragged eye was visible in the satellite pictures but later it became obscured by high cloud. After recurving, Namu moved towards the southern islands of Vanuatu but dissipated before it could affect the group.

Tropical cyclone Namu was not a very intense cyclone when it affected the Solomon Islands, being only a storm and later of marginal hurricane intensity over Guadalcanal and farther southwest. However, because of its slow movement across the group and the prolonged torrential rainfall caused by it, massive damage occurred to the country, estimated at twenty million dollars. It left more than a hundred people dead, thousands injured and about 90,000 people homeless.

From the information available, it is deduced that hurricane or storm force winds affected Malaita, Small Malaita, Guadalcanal, Bellona and other smaller islands within 30-40 miles from the centre of the cyclone. Gales covered a greater area, extending as far north as Russel Islands to the northern tip of Malaita and the whole of San Cristobal in the south. Gusts in hurricane-affected areas were estimated to be up to 100 knots. The areas worst hit by Namu were the east Malaita Province and Guadalcanal Plains. Here, extensive areas of irrigated rice crops were swamped under floodwaters and mud.

Most death and damage resulted from floods and mud slides rather than the direct effect of the winds. Flooding is reported to have caused meandering rivers to cut a straight path which brought tons of mud, silt


GLOBAL TROPICAL CYCLONES
NO. NAME INTENSITY DATE
1 ALISON H(75) APRIL 7-13
2. MARTIN T(60) APRIL 9-14
3. MANU H(APRIL 23-26
4. KEN H(90) APRIL 24-MAY 3
5. BILLY/LILA H(80) MAY 5-12
6. NAMU H(80) MAY 15-22
7. LOLA H(150) MAY 17-23
8. MAC T(45) MAY 22-29
NO. NAME
9. AGATHA
10. ANDREW
11. BLAS
12. NANCY*
13. BONNIE
14. CELIA
15. OWEN*
*BASED ON TROPICAL CYCLONE WARNI
SEYCHELLES ISLANDS
DIEGO GARCIA ISLANDS
MADAGASCAR
MASCARENE ISLANDS
VOLCANO ISLANDS
MARCUS ISLAND
MARSHALL

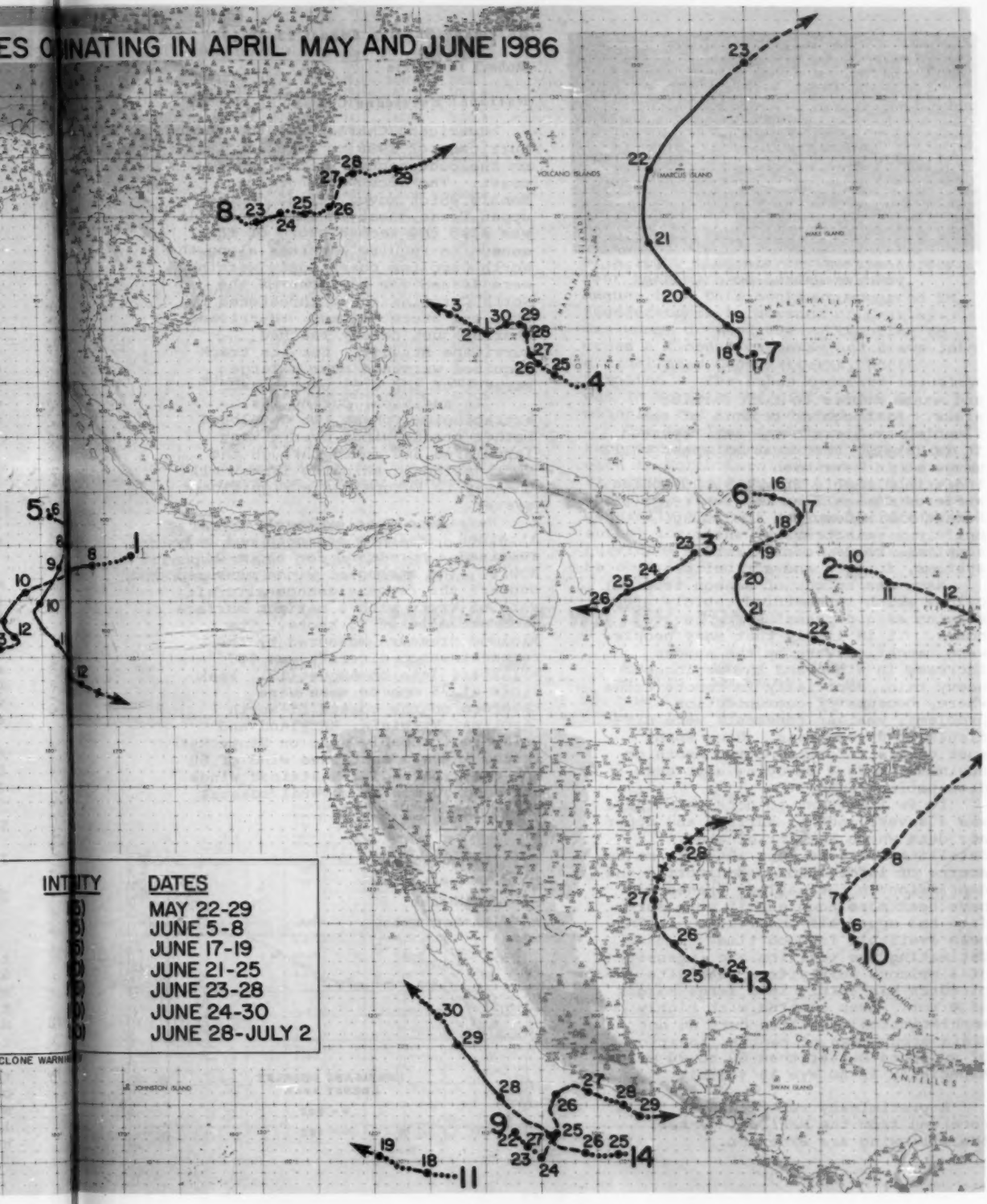

ES ORIGINATING IN APRIL MAY AND JUNE 1986
VOLCANO ISLANDS
MARCUS ISLAND
WAKE ISLAND
MARSHALL ISLANDS
LINE ISLANDS
JOHNSTON ISLAND
SWAN ISLAND
GREATER ANTILLES
INTENSITY
DATES
MAY 22-29
JUNE 5-8
JUNE 17-19
JUNE 21-25
JUNE 23-28
JUNE 24-30
JUNE 28-JULY 2

Figure 33. -- Famous World War II battleground, some 44 years later, devastated by tropical cyclone Namu. Wide World Photo.

and waste debris to rich farming areas. Although no reports of sea flooding or storm surge was reported, it is likely, that coastal areas where surge would have been indistinguishable from river flooding, suffered damage from the sea (fig. 33). Damage was widespread including buildings, electricity, water supplies, roads, communication systems, forests and agriculture.

Namu was an out of season tropical cylone which intensified rapidly after staying as a depression for several hours. It is likely that many people were caught unaware by the sudden increase in winds and the prolonged heavy rain, especially in remote areas where, because of communication problems, weather forecasts were difficult to disseminate. Namu spent most of its lifespan moving south or southwest before recuving east and dissipating rapidly.

It is important to note that there was a severe lack of surface and upper air data where Namu originated. Satellite pictures were the only major source of information. Monitoring the depression in the earlier stages may have been more accurate if more surface and upper air observations had been available in good time. Estimating the position and intensity of a cylcone solely from satellite pictures can result in a large margin of error. Even centres with highly sophisticated satellite data do not claim accuracies of central locations of cyclones better than 60 to 90 miles especially if no eye is visible.

A preliminary report was received from the National Center; the following are excerpts.

Hurricane Charley August 13-30, 1986

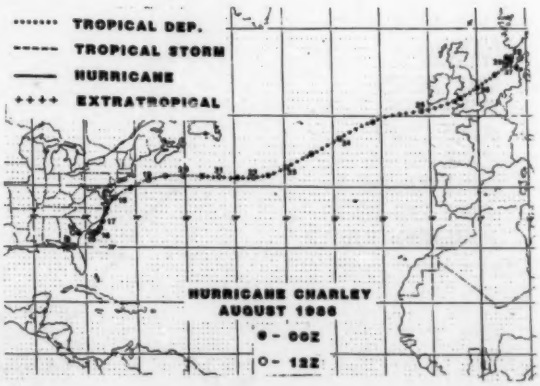
Robert C. Sheets

National Hurricane Center

Hurricane Charley was the second hurricane of 1986 to make landfall on the continental United Sates coast. The first was hurricane Bonnie which moved inland on the upper Texas coast in late June. It was also the second storm of the season to require warnings along the North Carolina coast (gale warnings were issued for portions of the North Carolina coast threatened by tropical storm Andrew). Hurricane Charley just barely reached hurricane strength, but its track required warnings over a large stretch of the U.S. east coast.

In addition, during its extratropical phase, it developed rather strong winds over a very large area and moved through the North Atlantic shipping lanes, all the way to Europe, as a significant system.

Hurricane Charley barely attained hurricane strength and only remained a hurricane for about 24 hours. The strongest winds measured onboard the reconnaissance aircraft were 65 knots with a maximum surface wind estimate of 75 knots. The minimum pressure measured by the reconnaissance aircraft was 987 millibars late on August 17. Peak winds of 75 mph or more were recorded on the coasts of North Carolina, Virginia, Maryland and Delaware (probably also on Nantucket Island where a sustained wind of 60 mph was reported). Sustained winds exceeded 50 mph at several coastal locations.



DATE/TIME	SHIP	LAT.	LON.	WIND DIR./SPD.	PRESS
16/1200Z	WFZC	33.7	76.6	140/35	1009.7
16/1800Z	WLCG	33.3	74.5	180/36	1013.8
17/0000Z	VCWZ	33.9	76.9	110/35	-
17/1200Z	CBFA6	33.9	74.1	160/35	1010.8
18/0600Z	GHZK	37.0	76.1	330/37	1000.0
18/1800Z	9VPU	40.5	72.0	070/35	1009.0
19/0000Z	WSNH	38.9	70.2	200/46	1000.8
19/1200Z	?	38.2	68.4	250/38	1006.8
"	HOQH	38.7	66.2	240/44	-
19/1800Z	PFER	39.3	63.8	230/45	1006.0
20/0000Z	PFER	39.3	64.0	260/42	1007.1
"	D5ZA	39.9	61.2	210/43	1008.0
"	?	40.6	60.8	200/38	1005.7
"	KMHF	43.8	60.1	100/49	1007.8
20/0600Z	KMHF	43.8	60.1	060/40	1005.7
"	LFMO	43.8	60.7	060/38	1005.0
"	CG3V	45.3	59.8	070/35	1013.2
20/1200Z	D5XA	39.8	63.3	320/44	1015.0
"	?	40.5	63.0	330/38	1010.9
"	9VBS	42.4	63.1	360/37	1013.5
"	KMHF	43.8	60.1	040/66	1008.8
"	LFMO	43.8	60.7	060/40	1009.3
"	VSG8	44.2	58.4	050/55	1007.2
"	GCXD	45.6	57.9	090/37	1014.2
20/1800Z	ELEA7	39.3	54.8	240/35	1005.5
"	ELDZ7	40.6	52.4	150/38	1009.5
"	VRKB	41.1	60.3	340/38	1008.0
"	KMHF	43.8	60.1	030/47	1014.1
"	CG8V	45.6	57.8	060/40	1015.4
"	GCXD	46.0	53.7	080/37	1015.3

Table 5. -- Ship reports from Charley. Wind direction in degrees, speed in knots and pressure in millibars.

Table 5 contains reports from ships experiencing gale force or stronger winds in the vicinity of Charley during its tropical storm phase. The track of the storm through the North Atlantic shipping lanes is reflected by the large number of vessels experiencing these stronger winds. Two to three times this number of ships (not listed in table 5, experienced gale force or stronger winds during the extratropical phase of Charley as it moved across the Atlantic.

There were five deaths reported as associated with hurricane Charley. Three of those deaths came in the crash of a light aircraft in Chesapeake Bay near Baltimore on Sunday evening, August 17. This accident occurred in thunderstorms in advance of Charley. One woman drowned when attempting to cross a flooded causeway and drove into a canal near Cape Hatteras, North Carolina . The other reported casualty was in Norfolk, Virginia where a motorist ran into a downed tree.

The American Insurance Association reported insured losses of $3 million each in North Carolina and Virginia and $1 million in Maryland. Past history has shown that insured losses are generally one half to one third of actual losses. The total loss for hurricane Charley then is estimated to be about $15 million.

HURRICANE WATCH, 1986

Jan.

Aust. - S. Pac.

88	T
Hector	T
Pancho	T
Vernon	T
Winifred	H

S.Ind.

Delifinina	H
Costa	H
068	T
Ophelia	H
Ernesta	H

N.Ind.

018	T

Feb.

Aust. - S. Pac.

Ima	H
June	T
Keli	T
Tiffany	T

S.Ind.

Filomena	T
Rhonda	T
Gista	H
Selwyn	T

W.N.Pac.

Judy	H

Mar.

Aust. - S.Pac.

Victor	H
Lusi	T
Alfred	T

S Ind.

Honorinina	H
Larissa	T
Jefroora	H

Apr.

Aust. S. Pac.

Martin	H
JOP	T
Manu	H

S.Ind.

Alison	H

W.N.Pac.

Ken	H

May

Aust. W.N. Pac.

Namu	H
	T
	H

S.Ind.

Billy	H

W.N.Pac

Lola	H
Mac	T

E.N.Pac.

Agatha	H

June

W.N. Pac.

Nancy	H
Owen	T

E.N.Pac.

Blas	T
Celia	H
Frank	H

N.Atlc.

Andrew	T
Bonnie	H

July

W.N.Pac.

Peggy	H
Roger	H
Sarah	T

E.N.Pac.

Darby	T
Estelle	H
Frank	H

Aug.

W.N. - Pac

Tip	H
Vera	H
Wayne	H

E.N. Pac.

Georgette	T
Howard	T
Isis	T
Javier	H
Kay	T

N.Atlc.

Charley	H

S. Ind.

348	T

Sept.

W.N. Pac.

Abby	T
Ben	H

E.N. Pac.

Lester	T
Madeline	T
Newton	H
Orlene	H
Paine	H

N.Atlc.

Danielle	T
Earl	H

Oct.

W.N. Pac.

Carmen	H
Dom	T
Ellen	H
Forrest	H
Georgia	T

E.N. Pac.

Roslyn	H

THE EDITOR'S DESK

Letter of Concern

EXXON

FROM CAPTAIN JOHN A. MAZZA

TO U.S. DEPT. OF COMMERCE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

SUBJECT MR. JULIUS SOILEAU; NATIONAL WEATHER SERVICE

VESSEL S.S. EXXON LEXINGTON

PORT VIA LOS ANGELES

DATE 11/3/86

DEAR SIR:

I HAVE JUST READ ABOUT AN ACCIDENT THAT WAS SUFFERED BY MR. JULIUS SOILEAU DURING ONE OF HIS SHIPBOARD VISITS IN HOUSTON, TEXAS. I AM NOT SURE HOW TO GET THIS LETTER ROUTED TO ALL OF THE PROPER PLACES, BUT PERHAPS YOU CAN HAVE IT SENT TO AT LEAST HIS OFFICE IN HOUSTON.

THE SUMMER 1986 ISSUE OF "MARINERS WEATHER LOG" MENTIONS MR. SOILEAU'S ACCIDENT. I HAVE KNOWN MR. SOILEAU FROM A SHIP'S OFFICER'S PERSPECTIVE FOR ABOUT TEN YEARS, AND I HAVE ALWAYS BEEN IMPRESSED BY HIS PROFESSIONALISM AND BY HIS FRIENDLINESS. HE WOULD ALWAYS BRING A SMILE AND A KIND WORD TO EVERY SHIPBOARD VISIT. HE WOULD MAKE SURE THAT WE ALWAYS HAD PLENTY OF WEATHER RELATED SUPPLIES, AND ALWAYS ASK US FOR ANY SUGGESTIONS OR COMMENTS. A TRIP TO THE HOUSTON OR BAYTOWN AREA DID NOT SEEM COMPLETE WITHOUT ONE OF HIS VISITS.

I HAVE NO IDEA HOW HIS RECOVERY HAS PROGRESSED, BUT I HOPE THAT PROGRESS IS BEING MADE. MR. SOILEAU WENT FAR BEYOND THE NORMAL JOB RELATED REQUIREMENTS. IF THERE WAS AN AWARD FOR THE BEST GOVERNMENT EMPLOYEE OF THE YEAR, THEN JULIUS SOILEAU WOULD BE MY CANDIDATE.

RESPECTFULLY YOURS,

John A. Mazza

JOHN A. MAZZA

CAPTAIN: S.S. EXXON LEXINGTON

Considering the circumstances Julius is making a good recovery. He is getting around with the aid of prosthesis and is able to drive. He is still undergoing therapy. The Houston Weather Service Office is hoping that he will decide to come back to work in the spring. His home address is 5911 W. Airport Rd., Houston, TX 77035 -- Editor.

Great Lakes Rescue

The HERBERT C. JACKSON, homeward bound for Rogers City, MI, rescued a pair of Indiana fishermen, who had been stranded on Lake Michigan for three days. Captain Arnold Robertson and his crew are one of our Great Lakes Weather Observers (fig. 34).

On September 28th Carl Ward and his nephew Todd Lawson set out on a coho fishing trip, from Michigan City, IN, in Lawson's 18-foot motorboat, without food. Ward explained: "we weren't going to be out but half a day but it ended up a little longer". Apparently the boat ran out of gas after the pair had to dodge some Sunday night thunderstorms. Monday morning (29th) the Coastal Guard began to search Lake Michigan, south of Milwaukee. Five Coast Guard helicopters and a Falcon jet were hampered by cloud cover as low as 200 feet, and visibility down to ½ mile, according to Chief Petty Officer Michael Glenn of the Wilmette station.

Lawson's boat was equipped with a CB radio but it was a signal light that attracted the attention of the HERBERT C. JACKSON crew, about 180 miles northeast of Wilmette. The two men returned in good condition following the ordeal.

The following letter was sent from the Director, National Weather Service Central Region:

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE CENTRAL REGION
601 East 12th Street, Room 1836
Kansas City, Missouri 64106

October 10, 1986 W/CR4x7

Captain Arnold Robertson
c/o Robert F. Dorn
Manager of Operations
Interlake Steamship Company
1100 Superior Avenue Northeast
Cleveland, OH 44114

Dear Captain Robertson:

I received word of the fine rescue of the two Indiana men that you and the crew of the str. HERBERT C. JACKSON performed on Lake Michigan.

This rescue is another example of the high regard that you and your crew have for the protection of life and property. Another example is the cooperative weather reports that you do for us.

We appreciate what you are doing. I commend you and your crew, and know the fine work will continue.

Sincerely,

Richard P. Augulis
Director

cc: PMD, Robert Collins, WSFO Chicago, IL
PMD, George Smith, WSFO Cleveland, OH
Editor, Marine Weather Log, Washington, DC

Figure 34. -- A hero on the Great Lakes. Wayne Farrar Photo.

MARINE WEATHER REVIEW

April 1986 -- The Icelandic Low is usually beginning to weaken during the spring transition period and its 1005-mb center is normally off the Kap Farvel. This month the center was northeast of its normal position (fig. 35) and higher. In fact pressure was up over most of the northern North Altantic, with a +9mb departure centered over the Grand Banks. Pressure was down off the mid Atlantic coast of the U.S. -- enough to enclose a 1010 mb center for the month. The subtropcial high was slightly stronger than normal and a little north of its usual position. A look at the track chart for the month shows a flurry of activity over Iceland and in the Denmark St with another cyclonic area north of Bermuda. The area east of the Grand Banks, with a lack of storm tracks, reflects the higher than normal pressure in that region. A few storms trekking through the Mediterranean were enough to cause a -4mb pressure anomaly in the Gulf of Genoa.

These surface features were also reflected at the 700-mb level where positive anomalies showed up east of the Grand Banks and in the Norwegian Sea and negative anomalies appeared over the Bay of Biscay and north of Bermuda. This resulted in troughs at both ends of the Atlantic and a ridge in the middle.

On this Date -- April 12, 1934 -- The wind reach 231 mph at Mt. Washington NH. For 5 min, speeds averaged 186 mph. It was the highest windspeed ever clocked in the world. This same observatory measured 186 mph in connection with the famous New England hurricane of Sept. 21, 1938. In both cases the speeds were influenced by the orographic effect of the mountain.

Extratropical Cyclones-- The month opened with a flurry of activity on both sides of the Atlantic. Two low pressure systems were moving across Canada while another one had developed west of Portugal. Throughout the month there was very little activity in the mid North Atlantic as far north as 50°N. The Norwegian and North Seas were also spared for the most part. Most of the action was concentrated between Newfoundland and Iceland and in the western North Atlantic west of about 55°W. The British Isles suffered in the last throes of winter for a good part of the month as frontal systems brought cold winds and snow on several occasions. In fact central England had its coldest April since 1922. On the 23d a coastal low brought a mixture of rain and snow across Tidewater Virginia and the Eastern Shore. In many areas this was the latest recorded snowfall since records were first kept in 1871.

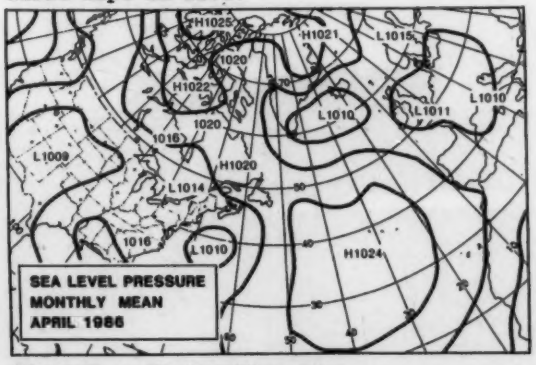


Figure 35. -- The transition season.

"Just when you thought it was safe to go back to sea"

The Monster is Back

The Weather Logs combined with the cyclone tracks, U.S. Ocean Buoy Climatological Data, gale and wave tables and mean pressure patterns provide a definitive report on the primary storms that affected the North Atlantic and North Pacific Oceans. The monster of the month is a title given to an extratropical system that may have been particularly dangerous. Unless otherwise stated, all winds are sustained and not gusts; all times are G.M.T.

North Atlantic Weather Log
April, May and June 1986

It was a LOW that had developed over Canada late in March. However it made its sea debut on the 1st of the month off the southern coast of Labrador. The AMERICAN PURITAN some 500 mi south of the center, early on the 2d, measured 40-kn winds in 20-ft swells. A little closer to the center the NEFTEKAMSK measured 50-kn winds, while the SUMY measured 54-kn winds in 26-ft swells on the 3d. The 984-mb storm headed southeastward until the 5th, when it finally turned toward the east northeast just north of 36°N. It moved across southern Portugal on the 6th, then spent the next week trekking across Europe.

Meanwhile some 450 mi east of New York a LOW came to life on the 3d. Before it was through pressure dropped to 962 mb, it moved across the Grand Banks and found its way up the east coast of Greenland and into the northern Greenland Sea. Feeling the sting of this storms fury were OSV C, ANTANAS SNECHKUS, MIKOLOYUS CHYURLIONIS, and MEERKATZE all reporting 43-to 48-kn winds in 20-to 25- ft swells, on the 4th and 5th. The storm was most potent on the 5th, when the central pressure dropped to 962 mb (fig. 36).

This LOW developed out of a complex frontal situtaion near 45°N, 45°W on the 7th. Its path was similar to that of the month's first storm. At 1800 the STOR encountered 45-kn westerlies near 43°N, 47°W. The following day the WAARDRECHT (40°N, 38°W) ran into 50-kn winds in 20-ft swells. The LOW at 1010 mb was swinging southeastward. By the 10th it began to turn toward the east northeast. At 1200 the VILLE DE GENES radioed north winds at 37 kn some 300 mi northeast of the storm's center. By the 11th the system moved past the Straits of Gibraltar, across southern Spain and into the northwestern Mediterranean. It crossed the Adriatic on the 12th.

Two LOW's crossed paths to produce a day or two of rough weather in the northwestern Atlantic on the 10th. The main system originated in the Northwest Territories of Canada on the 6th. It skirted the southwest shore of Hudson Bay, came through New England and, on the 9th, swung out into the Atlantic. Prior to this another system came to life off the Delmarva peninsula on the 7th. It moved northeastward but on the 8th it was absorbed by the circulation of the larger system. This combined storm was a problem on the 10th when its central pressure dropped to 977 mb and storm force winds were being generated east and south of its center. The VCNP with a 989-mb pressure was caught in 52-kn south southeasterlies at 1200 on the 10th, while the 3BFA measured 43-kn winds in 20-ft seas at the same time, but a

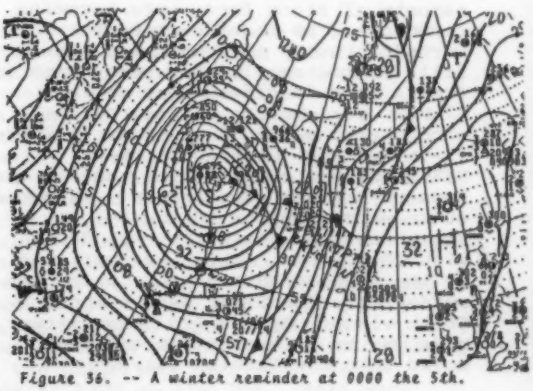


Figure 36. -- A winter reminder at 0000 the 5th.

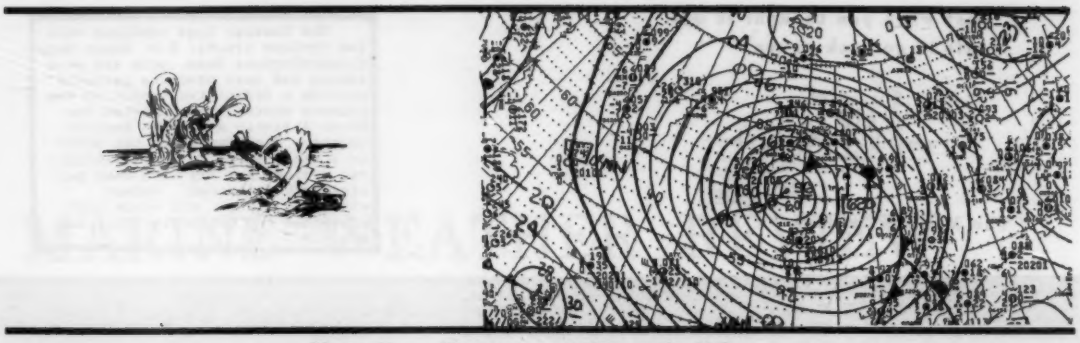


Figure 37. -- The monster at 0000 on the 20th.

lot farther south. The following day the bottom dropped out and this system was hardly recognizable.

Monster of the Month-- This potent storm was hatched in Tampa Bay, FL on the 13th. A thunderstorm at Key West brought a wind gust to 55 kn. Nothing much else was happening as the LOW rambled along the 30th paralell, until the 15th. It turned northward and intensified slightly, but not enough to get excited about. The SEALAND VOYAGER on the 15th and 16th provided some evidence that something was happening as she reported 42-to 44-kn winds in swells of about 25 ft. On the 18th the WAKATSUKAWA MARU and the IRVING FOREST measured winds in the 45- to 48-kn range in swells of 20 to 23 ft. The following day as central pressure dipped to 972 mb a host of vessels radioed in with 40-to 50-kn winds; these included the U.S.C.G. cutter VIGILANT at 1800 with 42-kn winds in 23-ft swells. At the same time the JOHAN PETERSEN, near 56°N 29°W, estimated winds at 60 kn with a 987-mb center while being buffeted by 26-ft seas. By the 20th (fig. 37) wind reports of storm force were becoming commonplace as the 956-mb center turned abrubtly southward and began to fill. Three excellent reports came in from a ship idenified only as the C7LM20, east of the center, as she encountered 42-to 53-kn winds in 20-to 25-ft swells. Once again the MEERKATZE was on the scene, and in the Denmark St. she came across a measured 60-kn wind from the northeast; in heavy snow her visibility was 200 yd with 20-ft seas. This was confirmed by the HVIDBJOERNEN nearby, which was suffering under 28-ft seas whipped by 56-kn winds. By the 22d this system gave way to a less potent one that moved into the British Isles.

A messy situation developed north of the shipping lanes toward the end of the month. A LOW that reached Angmagssalik, Greenland, on the 24th, from Missouri made its way across Iceland by the 26th. Meanwhile a secondary system was speeding from Hudson Bay, through the Davis St, across Greenland and into the Denmark St during this same interlude. The result was a couple of days of rough weather in these northern waters. The situation was made more complex by the infusion of a third system from Labrador. This LOW eventually became the dominant system and moved northward during the first few days of May. On the 29th we heard again from the HVIDBJOERNEN who was still in the Denmark St. At 1200 on the 29th she measured 58-kn east northeasterlies in 20-ft seas, which were down from 23 ft some 6 hr before. Earlier, on the 27th, she had encountered 56-kn winds in seas estimated at 36 ft. Along with her reports from the previous storm the week before this vessel warrants special notice. The MEERKATZE also comes in for special attention for her third storm encounter this month. On the 25th near 66°N, 27°W she hit 57-kn winds in 23-ft seas. OSV L on the 30th measured 40-to 49-kn winds in 20-to 23-ft seas as the month wound down. The LOW however not respecting our Georgian calendar kept right on trucking. Iceland felt its sting on the 1st of May and ship reports indicated winds were still at gale force. The SLETBAKUR (67°N, 23°W) came in with an estimated 60-kn wind at 1800. The combined system made its way northward on the 2d and began to fill.

Tropical Cyclones-- Since 1871 April has been the only month with no recorded tropical cyclones.

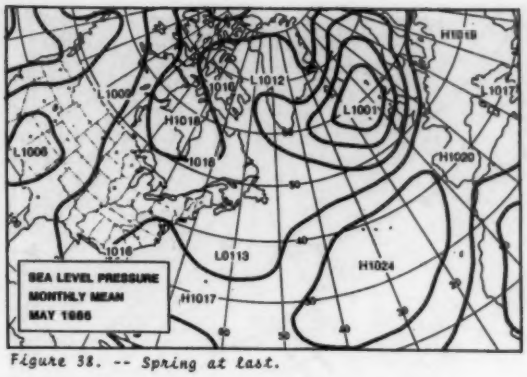


Figure 38. -- Spring at last.

Casualties -- In the Mediterranean, during heavy weather on the 14th, the EVERHOPE, now called PIRAEUS ROADS, collided with the bulk carrier WILDCAT. The tanker SAINT JOHN, Lavera for Amsterdam, sustained heavy weather damage to her bow thruster and main deck. On the 20th, off the African nation of Guinea the stern trawler DONG WON NO. 501 reportedly collided with the traweler ONDO NO. 1 in dense fog.

May, 1986-- This month usually sees the spreading of the Azores-Bermuda High with a resultant shrinking of the Icelandic Low. This year the High was there and was just centered a little east of its normal position(fig. 38). But between Iceland and Ireland there was a relatively strong low pressure area, which reflected the large number of storms that roamed these waters. If it was a regular feature rather than an anomaly it wold probably be known as the "Faeroes Low". The result of this activity was a negative 13 mb anomaly centered in these waters between Iceland and Ireland. The eastward shift of the subtropical high turned up a negative 5 mb anomaly near 35°N, 55°W, where a number of storms can be seen, and a postive 3 mb anomaly southwest of Spain.

The 700-mb story was similar with negative anomalies showing up in the same places. An upper level trough dug in off the East Coast of the U.S. and from Iceland to the Bay of Biscay. The storm tracks reflected this flow with a general trend from southwest to northeast across the Atlantic.

On This Date -- May 16, 1834 -- Marked the greatest May snowstorm to ever hit New York and New England. The hills around Newbury VT were covered with 2 to 3 ft of snow.

Extratropical Cyclones-- There was more extratropical activity than normal for the month of May, which usually marks the beginning of the good weather sailing season. Many of these systems were weak waves along fronts but there were several potent systems. The two major areas of activity were northeast of Bermuda and southeast of Iceland.

A short-lived storm developed west of the English Channel on the 3d. It moved into St Georges Channel on the 4th before crossing southern Ireland and moving back out to sea. At 1200 on the 3d several vessels just south of the LOW's center were encountering 35-to 45-kn winds in 15-to 30-ft seas. These included the TINEKE, SALMON POOL, BRITISH RESPECT, PIONER SEVERODVINSKA, CHAMAL and the F. FREILGRATH. The CANMAR EUROPE reported a 48-kn northerly, northwest of the storm center. In addition the associated cold front was producing some rough weather in the Mediterranean where the LA GOULETTE (39°N, 6°E) encountered winds estimated at 60 kn. On the 4th at 1200 the KOPALNIA MYSLOWICE ran into 52-kn winds near 50°N, 4°W. On the 5th the system was absorbed by another storm.

This system, which gobbled up the previous storm, continued to plague the waters off the British Isles through the 8th. The 996-mb LOW brushed the east coast of Ireland on the 7th. At 0000 on the 7th the PER TRADER ran into a 52-kn blow far to the northwest, some 200 mi south of Iceland. Closer to home ships such as the ESSO DEMETIA and the WESTERN PACESETTER I were reporting 35-to 45-kn winds. By the 8th the system began to fill.

A long-lived storm came to life on the 3d, the same day that the first storm developed west of the English Channel. However this LOW started just east of Edmonton, Canada. A long overland track took it across Lake Superior, Quebec Province, Maine and out into the North Atlantic by the 6th. This Edmonton Express was averaging nearly 900 mi per day. By the 6th mid Altantic shipping began to take notice. The DYUI SKAGERAK radioed several reports; at 1200 she measured 48 kn in 17-ft seas and 23-ft swells, near 36°N, 72°W. The ALEKSANDR MATROSOV, SNOW CRYSTAL, PACIFIC CRANE and the DENEB ran into 37-to 44-kn winds at 1200 on the 7th. Seas were

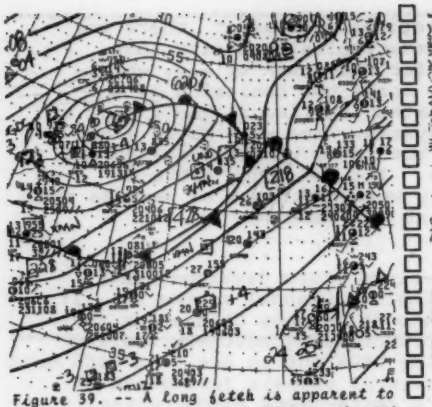


Figure 39. -- A long fetch is apparent to southeast at 1800 on the 8th.

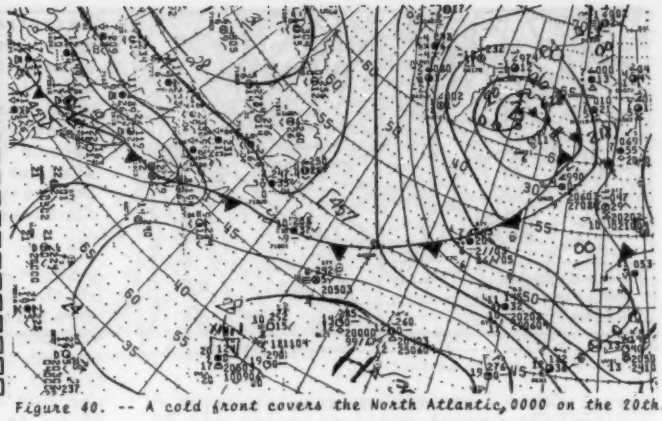


Figure 40. -- A cold front covers the North Atlantic, 0000 on the 20th.

running about 10 to 20 ft. By this time the storm was turning toward the northeast and continuing to intensify. From the 8th through the 10th central pressure was 980mb. At 1200 on the 8th CALANDA (44°N, 37°W) reported west southwesterlies at 52 kn with a 984-mb pressure; six hours later winds dropped to 47 kn as pressure rose 9 mb. The AMERICAN EAGLE was encountering 40-to 45-kn winds in swells up to 30 ft about 130 mi east of the center (fig. 39). The wind and wave field was being enhanced by a large 1024-mb HIGH that stretched from the eastern Mediterranean southwestward to near the Cape Verde Islands. A long southwesterly fetch was produced between the two systems. The CLARA MAERSK was caught in this vise and reported 20-ft swells in 40-kn winds late on the 8th. Rough weather continued for the next few days as the Edmonton Express moved into the Norwegian Sea on the 11th.

At the same time that the Express was developing over Edmonton, 400 mi to the south a LOW was coming to life over Helena, Montana. Their similar paths crossed several times and they both ended up off Norway on the 14th in the same relative position in which they started. The Helena Local took a more circuitious route and thus remained about 2 days behind the express. After crossing Hudson Bay on the 7th the storm dipped southward across Long Island and found its way into the North Atlantic on the 8th. The following day ship reports of 35 to 40 kn began to filter in; reporting ships included the ZIM CARMEL, HON PAUL MARTIN, MONTE SARMIENTO and the VYMPEL. On the 11th at 0000 the DBWV radioed 70-kn south southwesterlies in 20-ft seas some 480 mi east southeast of the center. The following day the 986-mb center approached the Hebrides on its way into the Norwegian Sea. At 1200 on the 12th near 56°N, 5°W the ISLE OF ARRAN was whipped by 54-kn southerlies; 6 hrs later she was estimating 68-kn winds. The system began to fill on the 13th.

On the 19th there were no less than seven low pressure centers roaming the North Atlantic. The one that became the most intense was a small LOW just east of Kap Farvel. It's initial 998-mb reading fell to 979 mb within 24 hr. The PEP ANTARES (59°N, 44°W) encountered 44-kn westerlies in 20-ft seas at 0000 on the 20th. A frontal system from the LOW extended southward (fig. 40), then westward all the way to New England. By 1200 the PEP ANTARES had winds reaching 52 kn. By the 21st the system began to sprawl, covering most of the Atlantic north of 45°N. Winds in general were running 35 to 50 kn with seas of 10 to 20 ft. The PEP ANTARES was now being ripped by 60-kn westerlies. OSV C hit 43-kn westerlies in 23-ft seas. The 968-mb center headed northeastward on the 22d. Gales were common throughout the storm's southern semicircle. Battling the storm were such vessels as the ROUSSKOIE POLE, AGPA, DELFINO II and the ALLURITY. This was one of the best reported storms of the month, which was a great help in forecasting. The storm remained potent until the 24th.

Continuing this month's trend of British Isle storms, a LOW developed on the 23d in the mid North Atlantic. It didn't look like much for awhile, but by the 25th it had organized into a large, complex system. Ships such as the KLIMOVO, KOVDOR, ZLATOOUST, and DOLNY SLASK were being buffeted by 35-to 50-kn winds in 10-to 15-ft seas.

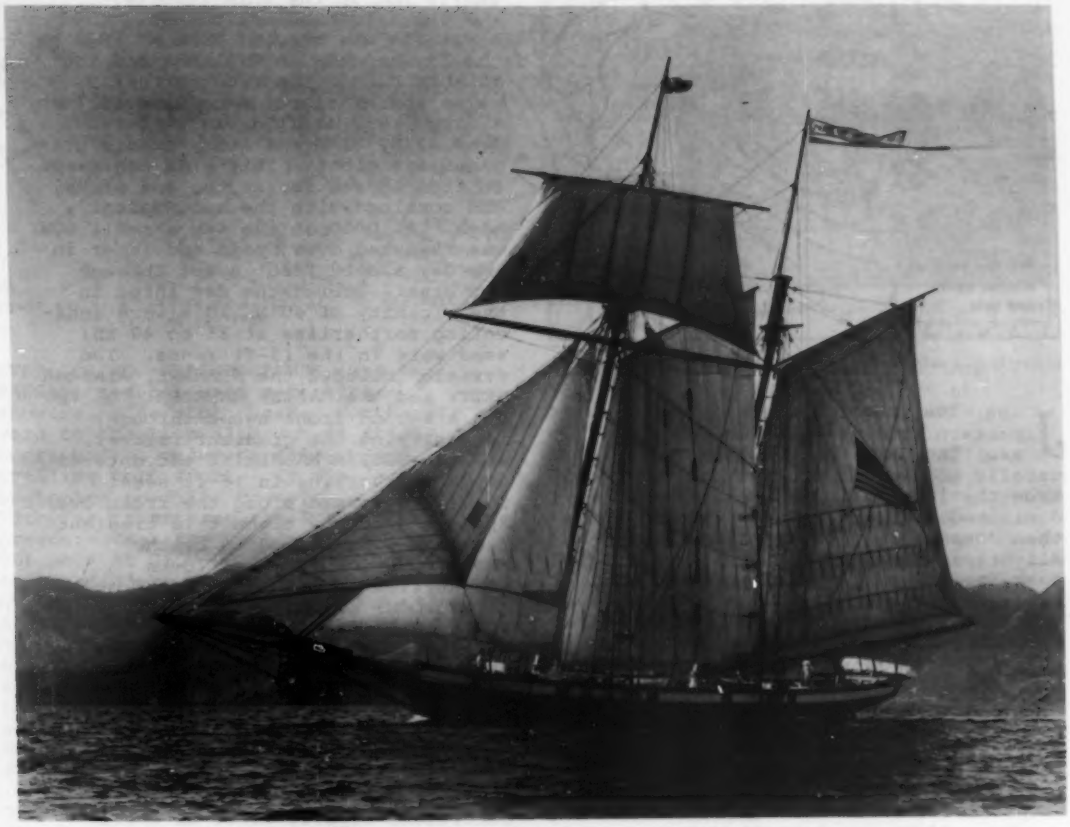


Figure 41. -- The loss of the PRIDE was mourned worldwide. Photo by Armin E. Elsaesser III.

During the day the center passed over the Faeroes on its way into the Norwegian Sea. By the 26th the storm was beginning to fill. It was losing a battle with several other centers that littered the northern North Altantic.

Tropical Cyclones-- No tropical cyclones developed this month. While they are uncommon they do occur. Since 1931 twelve tropical cyclones have formed in the North Atlantic and just two have reached hurricane strength. The last May hurricane occurred in 1970. Hurricane Alma was a short-lived storm but its remnants did dump some torrential rains over western Cuba, resulting in seven deaths. At Ft Myers, FL more than 6 in. of rain fell in a 12-hr period.

Casualties -- The worst tragedy of the month occurred on the 14th to the PRIDE OF BALTIMORE, showboat for the port city of Baltimore and the state of Maryland (fig. 41). The vessel was hit, with little warning, by severe winds, about 240 mi north northwest of San Juan, Puerto Rico. The Captain and three crew members were lost while the remaining crew of eight were rescued, on the 19th. (The full story will appear in the Winter 1987 issue of the Mariners Weather Log.)

On the 15th at 0230 the trawler ACHONDO sank in dense fog inside Vigo Bay (northwest Spain). All 15 crewmen were rescued. Fog was also reported to be the cause of a collision on the 27th between the ferries SPROGO and ROMSO outside the harbor of Halsskov, Denmark; two people were seriously injured and at least 20 were slightly injured. On the 23d the PARAVALOS and WU TAI SHAN collided in the thick fog off Cape Passero (Sicily). The STAR OF TEXAS suffered heavy weather damage on the 15th enroute to Amsterdam from Philadelphia. The ALZAWRAA sustained heavy weather damage between the 22d and 25th enroute from Aqaba to Antwerp.

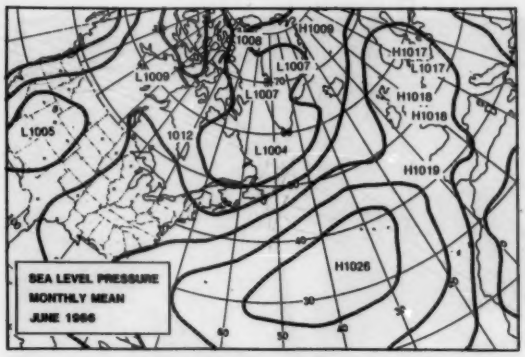


Figure 42.-- A welcome sight -- summer pattern.

June, 1986 -- The mean pressure pattern (fig. 42) was less than exciting this month; which is usually good news for mariners. It's true the 1026-mb Bermuda-Azores High dominated the water south of 50°N, but then doesn't it always? It was only slightly stronger than normal. The weak Icelandic Low was about 6 mb stronger than normal and shifted westward, to dominate the Labrador Sea, including Davis St and Baffin Bay. This is readly apparent on the storm tracks, which reveal a number of low pressure systems taking this route. The Denmark St was also the scene of some cyclonic activity, but for the most part shipping weather was not bad. That is aside from a June hurricane and tropical storm and some unusually windy weather off Portugal.

The 700 -mb level, which helps steer these storms, showed a general west southwest to east northeast flow, north of 40°N, from the U.S. to 30°W. To the east it was a northeastward flow reflecting a trough, which dug in from Greenland to northern Africa.

On This Date -- June 25, 1888 -- About this time the residents of New York City were suffering through a record heat wave. For 14 straight days average daily temperatures (max.+ min. /2) were about 80°F. This was in sharp contrast to the severe March blizzard that year, which buried the city under nearly 2 ft of snow.

Extratropical Cyclones-- Monster of the Month In most cases the monster is a big, sprawling visible LOW that dominates weather over one-half the ocean. This month it wasn't even really a LOW and it only affected a small area off the Portuguese coast. The tale was not told on the weather charts but in the ship reports.

The first indication that something was brewing came at 1800 on the 3d when the JALAVALLABH and the YOLANDE DELMAS reported northerly gales and pressures exceeding 1012 mb. A large 1038-mb HIGH was centered near 42°N, 33°W and its pressure gradient was tight. This HIGH had swept in from Hudson Bay at the end of May and combined with the subtropical high. At 0000 on the 4th a small LOW was analyzed over Spain and later in the day a cold front swept through the area. During the day ships in the vicinity of 40°N, 10°W were indicating northerlies at 35 to 40 kn; seas were in the 13-ft range. The vessels included the NEBHANA, ALABAMA GETTY and the MAERSK HARRIER. On the 5th a second front swept through, intensifying the gradient further, and the NOSIRA MADELEINE encountered 60-kn northerlies in 16-ft seas. A small LOW formed along the front over Spain. Just how tight this gradient became was testified to by the RETAVAS, which measured 78-kn northerlies at 1800 on the 6th, near 40°N, 10°W; she encountered swells of 30 ft. If this appears to be exaggerated, check this report by the REKORD (40°N, 11°W) at 1200 on the 7th; she measured north winds at 81 kn in 20-ft swells. Previously the SOFIA hit 78-kn northerlies while the MEDIK ran into a 74-kn blow in the same area on the 6th. This invisible threat continued until the 8th, when conditions finally eased in these waters.

This LOW came to life in northern Alberta, Canada on the 6th. Its deepening 986-mb center swung across central Hudson Bay on the 8th and through Newfoundland the following day. By the 10th it was at sea and the central pressure had fallen to 980 mb. Its cold front swung southward then southwestward through northern Georgia (fig. 43). Most of the action along this front was from about 39° to 46°N. Measured winds, on the 10th, were running about 40 to 45 kn in seas and swells of 20 to 30 ft. Reports were sent in by many vessels, including the TFL DEMOCRACY,

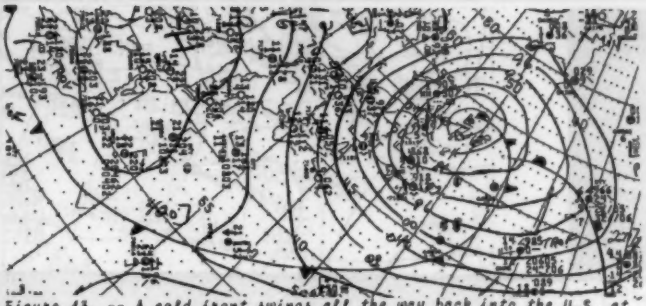


Figure 43. -- A cold front swings all the way back into the U.S. at 0600 on the 10th.

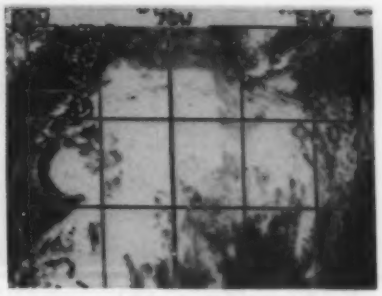


Figure 44.-- Andrew heads for the Carolinas on the 6th.

EVER SPRING, KRASNOOUFIMSK, and the PASSAT; several were reporting showers. The storm headed northeastward on the 11th although it still continued to generate gales along its trailing cold front. It was beginning to fill, however, and by the 13th, as it entered the Denmark St., pressure near the center was up to 986 mb. At 0600 on the 13th OSV C reported 35-kn winds in 20-ft swells. At 1800 just ahead of the front, the ELNIA encountered 47-kn winds near 63°N, 20°W. The storm remained identifiable until the 15th near Svalbard. Late on the 14th the frontal system moved ahead of the storm and played havoc over the North Sea. Ships and rigs were reporting 35-to 45-kn winds.

On the 16th at 1200 this LOW was forming just east of Lake Superior. It swung across Quebec and northeastward into Newfoundland on the 17th. Its 982-mb center trailed a cold front southward into the Gulf of Maine and the back across the Delmarva Peninsula. Ahead of the front, ships were encountering gales from the south through southwest. The KMHF (44°N, 60°W) reported 49-kn south southwesterlies. Behind the front ships like the CAMILLE MARCOUX, EMPIRE STATE and the VCWZ were running into 45-to 50-kn winds, north of 45°N. The storm moved into the Labrador Sea on the 19th. However it was beginning to weaken and the system's effect on shipping became minimal. The frontal system was still causing some gale force winds as it began to stall.

Along a front that swung northeastward from Florida, a LOW developed near 35°N, 68°W on the 22d. While this storm was short-lived it did create some problems over the shipping lanes. These problems arrived mostly in the form of gales. The VINLAND's report of 35-kn southerlies, near 44°N, 60°W, at 1200 on the 23d was typical of the effect on shipping. The KMHF Also submitted several reports of 35-to 40-kn winds in these waters. At 0600 on the 24th the VCNP encountered west southwesterly winds at 38 kn, near 44°N, 60°W in 8-ft seas. By this time the LOW had moved into the Gulf of St Lawrence -- its graveyard. Gales continued along the front as another LOW from the Great Lakes took over. It was not a strong storm but it did inherit the frontal system, which remained active. At 1800, on the 25th, the ALGOPORT confirmed this with a report of westerly 50-kn winds, in 10-ft seas near 49°N, 64°W. The LOW moved off Labrador on the 26th and approached the Denmark St the following day.

Tropical Cyclones-- The North Atlantic season started on schedule this year as tropical storm Andrew developed over the central Bahama Islands on the 5th. The disturbance from which Andrew was spawned, was responsible for heavy rains and floodings in Jamaica a few days before; several deaths due to the flooding were reported. The system reached tropical storm strength at 0000 on the 6th some 225 mi (fig. 44) southeast of Charleston, SC. It was moving northwestward at 8 kn. It's center approached within 100 mi of the South Carolina coast before recurving. Maximum sustained surface winds have been estimated at 45 kn in the 2-day period that Andrew skirted the U.S. mid-Atlantic coast. Strongest winds were concentrated on the east side of the storm. The AFRICAN METEOR, 100 mi east of the center, at 1200 on the 7th, ran into 35-kn southeasterlies in 13-ft

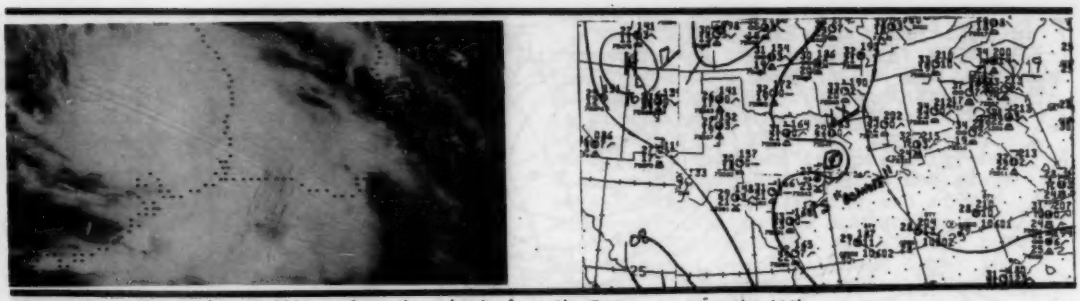


Figure 45. -- Bonnie by satellite and weather chart along the Texas coast on the 26th.

swells. At 0000 on the 8th about 120 mi north of Andrew's center, one of the ELCO ships reported 36-kn winds from the south in 20-ft swells. The weakening system was eventually absorbed by a large LOW over eastern Canada. A drowning death in a strong undertow, in North Carolina, was attributed to Andrew.

Hurricane Bonnie came to life on the 23d and became only the eleventh June hurricane to make landfall in the U.S. this century. There have only been seven other years this century when two or more tropical cyclones, reaching at least tropical storm strength, formed in June.

While forecasters had been tracing an upper level system for several days it wasn't until the 22d, west of Sarasota, FL, that the low-level vortex became apparent. The following day convection had organized sufficiently for the system to be called a tropical cyclone. At 1500 on the 24th, Bonnie was already a tropical storm as reconnaissance found 50-kn winds. During the next 24 hr the storm moved west northwesterly and continued to strengthen. At 1800, the ARILD MAERSK, about 80 mi southeast of the center, and the DELAWARE TRADER, about 30 mi northwest of the center, both encountered 35-kn winds; the former reported 13-ft seas. Bonnie was upgraded to a hurricane just 2 hr before. On the 26th the hurricane passed over the Conoco oil rig WC 459A and just south of Mobil oil rig P12 WC353, before making landfall (fig. 45)just southwest of Sea Rim State Park.

Before landfall the CHESAPEAKE TRADER, enroute from Sabine Pass to Galveston, TX, went through the eye of Bonnie, 15 mi off the Texas coast (fig. 45). The highest winds at the oil rigs were gusts to 84 kn at P12 (anemometer height 181 ft) and 72 kn sustained at WC 459A, with gusts to 79 kn (anemometer height 80 ft). The winds at Sea Rim State Park reached 67 kn with gusts to 85 kn.

Overland Bonnie produced heavy rainfall and at least 11 tornadoes. Ace, TX received 13 in. This rain produced local flooding as well as flooding along the Sabine and Neches Rivers. There were three deaths attributed to Bonnie.

Casualties -- The Danish vessel ANNE SORINE sank 80 mi off Cleveland (northeast England) at 1130 on the 8th. Five persons were onboard and two were picked up by the BETTY BORSMOSE; three were missing. On the 3d the HAMBURG, Helsinki for Bremerhaven, with containers, grounded in thick fog on Ostergrund, Helsinki approaches; the vessel was refloated later that day. In heavy weather on the 10th the ANDROMACHE dragged anchors and banged the pier at Viareggio, Italy -- burial place of Puccini.

Eight people, including two children, were missing, on the 27th after the Norwegian ferry PETER WESSEL and the Swedish cargo ship SYDERFJORD collided off northern Denmark, near the entrance to the Baltic Sea. The collision occurred in thick fog and all the missing were from the SYDERFJORD. According to the purser onboard the PETER WESSEL, the Swedish ship was sliced in two and sank in about 40 sec. None of the 1,350 passengers on the ferry were injured. Three crew members from the SYDERFJORD were able to jump into a rubber dinghy and were rescued.

The stand-by safety vessel BAHAMA broke free from her tow on the 20th and ran aground on Aldeburgh Beach (south of Great Yarmouth). She was holed beneath the waterline about six times on the stony beach. The North Sea, whipped by near gale winds, pounded the converted trawler.

North Pacific Weather Log
April, May and June 1986

April, 1986 -- The western Pacific looked farily normal this month (fig. 46). The large subtropical high was slightly stronger than normal, which was reflected in postive 5 to 7 mb anomalies. Its influence also extended a little farther to the northwest, resulting in a squeezing of storm tracks along the Kuril Is. Cyclonic activity was abundant in the Gulf of Alaska where a 1007-mb center reflected a -3mb anomaly. The 700-mb level had pretty much the same picture with an east northeasterly flow across the central Pacific and a slight tightening of the gradient south of the Alaskan Gulf, responding to the buildup of the subtropical high.

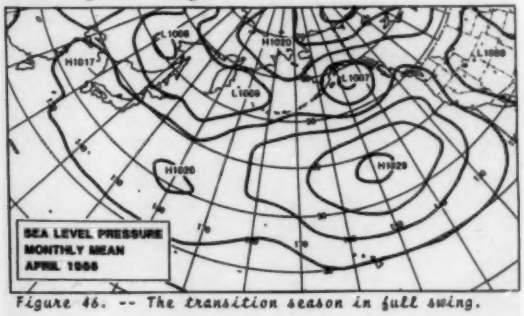


Figure 46. -- The transition season in full swing.

On This Date -- April 7, 1976 -- Typhoon Marie moved through the Northern Palau Is. During the night of the 7th through the morning of the 8th, Marie passed just north of Kayangel Is and 70 mi north of Koror. The Koror weather station recorded a peak gust of 90 mph with a pressure of 989 mb. Total rainfall was 18.56 in. No deaths or injuries occurred but damage was estimated at more than $4 million.

Extratropical Cyclones-- The Gulf of Alaska was a behive of activity this month. Many of the storms moved in from the southwest, particularly early and late in the month. Except for a few storms, the western Pacific was relatively quiet. The Sea of Okhotsk had plenty of action as did the Bering Sea. Storms throughout the month tended to move northeastward, north of 40°N. One that developed in the Gulf of Alaska, on the 10th, developed into quite a blizzard across the northern U.S. and Great Lakes around the 15th(fig.47)and ended up off the East Coast of the U.S.

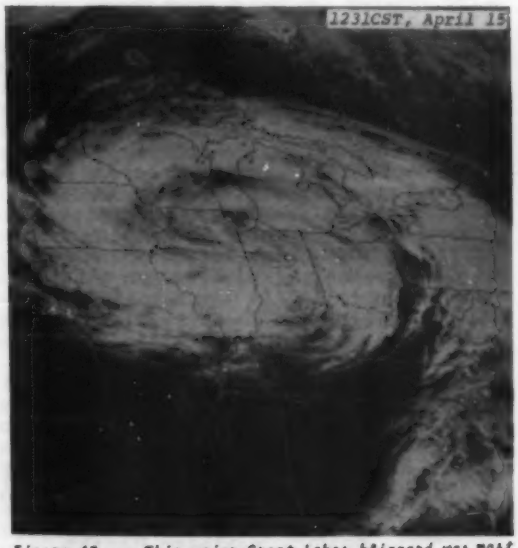


Figure 47. -- This major Great Lakes blizzard was most devastating in South Dakota where 80-kn gusts whipped snow into 15-ft drifts and caused millions of dollars in damage.

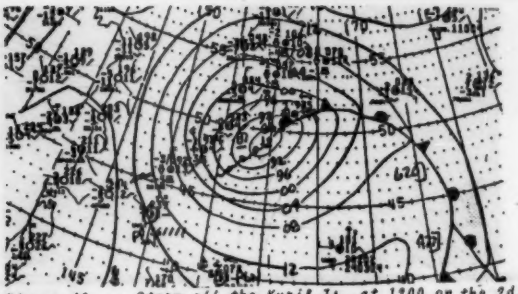


Figure 48. -- Storm off the Kuril Is. at 1200 on the 2d.

A cold front out of the Gulf of Alaska (storm described in the March Log), continued southeastward after the LOW had degenerated on the 4th. On the 5th offshore from Orange County and on the 6th offshore from Los Angeles Airport, several waterspouts, triggered by this front, were reported.

This Gulf of Alaska storm actually formed off Kyushu toward the end of last month and is described in the previous issue of the Log. It did persist until the 4th when it finally died over British Columbia.

While the previous storm was beating itself out along the rugged Canadian coast another Gulf of Alaska storm was being spawned, along a cold front, near 35°N, 170°E, on the 2d. Actually the main system along the Kurils looked like the dominant LOW (fig. 48). However by the 4th the baby had taken over and was absorbing the Kuril storm as it raced northeastward. Central pressure dropped to 972 mb over the Alaska Peninsula. Snow was being reported over the southeast Bering Sea and Bristol Bay where air temperatures were running between 0° and -10°C. The PACIFIC VICTORY, some 200 mi south of the center, was rocked by 40-kn winds while being rolled in 23-ft seas. The COLORADO HIGHWAY in 23-ft swells, measured 45-kn winds, near 54°N, 153°W, early on the 5th. The storm was now crossing the Kenai Peninsula and losing some steam.

Monster of the Month

This double-lived system sprang to life, on the 4th, east of northern Honshu.

Moving northeastward it intensified rapidly. By 1200 on the 6th(fig. 49), east of the northern Kurils, central pressure had dropped to 960 mb from an initial reading of 1007 mb 48 hr previous.

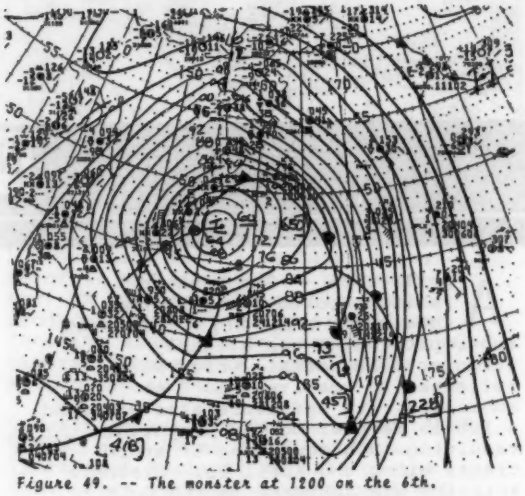


Figure 49. -- The monster at 1200 on the 6th.

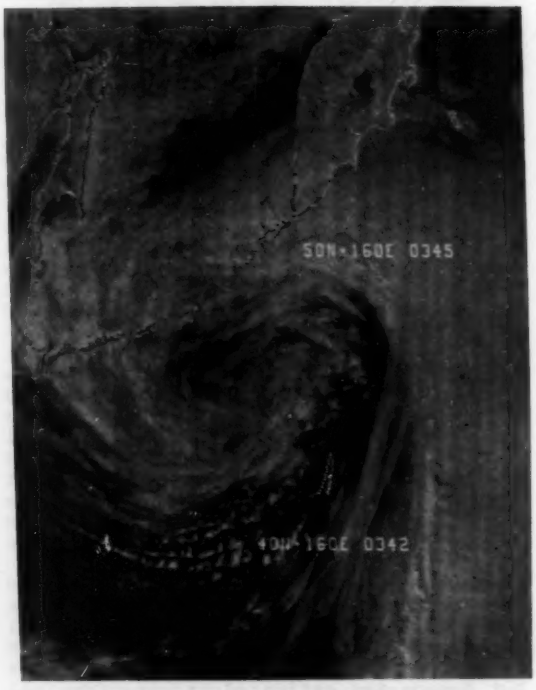


Figure 50. -- The monster from above on the 6th.

The PRESIDENT EISENHOWER at 2100, just north of the center, was clobbered by 54-kn easterlies in 20-ft swells. At the time they were also battling heavy snow in .25 mi visibility. The LAKE SUWA, SANTA BARBARA and the KATORI MARU encountered 40-to 55-kn winds in swells that ranged from 20 to 23 ft. The ALASKA RAINBOW, in visibility that was down to 200 yd, reported 54-kn measured winds in 20-ft seas, near 43°N, 153.5°W, at 0600. Gales extended out 600 mi in the storms southeast and southwest quadrants (fig. 50). On the 7th the storm abated somewhat but the battle was far from over. This can be attested to by the PACIFIC ANGEL, BUNGA MELAWIS and HYUGA MARU among others. By the 8th the 977-mb LOW was into the Bering Sea where it promptly reintensified, after absorbing another system from the south. Once again central pressure dropped to 960 mb (1200 on the 9th). The LUZON (52°N, 177°W) rolling in 20-ft seas was blasted by 52-kn winds at 0600; her visibility was down to 200 yd at the time. She had endured these conditions for 6 hr. The PACIFIC VICTORY, ARCTIC TOKYO and LOUIS MAERSK all felt the sting of the double-lived storm. It wasn't until the 12th that the Pacific was finally rid of this terror as the LOW limped ashore west of Bethel, AK.

While the Gulf of Alaska was not hurting for cyclonic activity it had been nearly 2 weeks since they had a real good shot. This was about to end thanks to a potent LOW that had developed in a trough near Midway Is, on the 16th. The ACACIA ACE probably didn't realize it, but their report of west southwesterly winds at 10 kn with 1005-mb pressure was a clear indication of a definite circulation (all observations are important). Once out of the chute, the storm was roared northeastward and intensified. The PRESIDENT WASHINGTON had several encounters with this system. On the 18th at 0300, near 45°N, 158°W, she ran into 62-kn north northeasterlies in 30-ft seas. As the system pushed its way into the Gulf a tight pressure gradient developed between it and a 1032-mb HIGH to the southeast(fig. 51). Seas of 20 ft and more were common in this region, on the 19th. The QUEENS OPAL, in 20-ft swells was measuring 41-kn winds, while the KEYSTONE CANYON, on the 20th, ran into 50-kn winds also in 20-ft swells. Similar stories came from the THOMPSON PASS and the PHILADELPHIA, which reported 33-ft

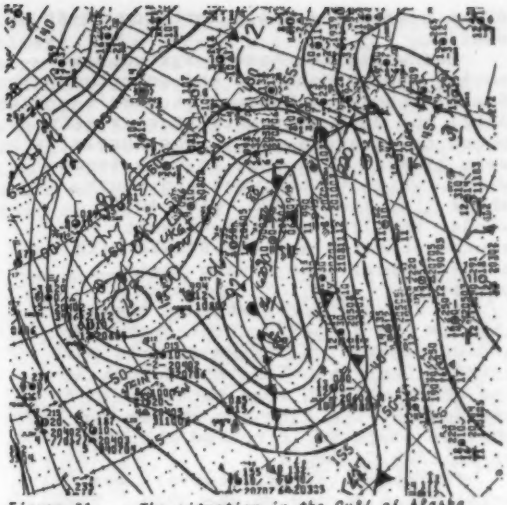


Figure 51. -- The situation in the Gulf of Alaska 0000 on the 19th.

swells. By this time the still potent storm was reaching the coast of Alaska through Prince William Sound.

The last week of the month was filled with action. A relatively weak LOW, which had developed on the 20th, after nearly petering out on the 23d, near 48°N, 151°W, got a second life. On the 24th its central pressure plummeted to 986 mb as it approached the British Columbia coast. It caught a number of vessels by surprise. The SEALAND MARINER was blasted by 66-kn winds, in 26-ft seas, near 52°N, 141°W at 1200. Nearby the CG 6258 measured 55 kn in 33-ft seas; at 0000 on the 25th she estimated seas at 46 ft. Winds in the 40- to 55-kn range were common. The LAKE SUWA, who was heard from in an earlier storm, came in with 49-kn measured winds in rain which helped reduce visibility to 200 yd. The PRINCE OF TOKYO, PRESIDENT HOOVER and the OVERSEAS JUNEAU all provided helpful observatons under trying circumstances.

In the wake of the previous system, another Alaskan Gulf storm came to life on the 25th. Some 24 hr later on the other side of the Pacific, a Korean LOW was spotted near Inchon. By this time Alaskan storm, near 50°N, 147°W, was creating havoc with the already beleagured shipping traffic in these waters. The GREEN MAYA, NEPTUNE DIAMOND and SKAUGRAN reported westerlies at 40 to 55 kn on the 27th. The ACACIA ACE, near 53N, 141W measured

62-kn westerlies while battling 26-ft swells.

Meanwhile the Korean system was moving across Hokkaido and into the Sea of Okhotsk. However it wasn't until the 28th that this storm really began to create a stir. The Kurils were blasted with snow in gale force winds, while to the west and south, ships like the HO-SHO, with 40-kn winds, the JYRP with 47-kn west southwesterlies and the SYLVIA with a a 39-kn blow, were having their problems.

In the Gulf of Alaska on the 28th the LOW had looped counterclockwise and was weakening. Wind reports were in the 40-kn range and ships such as the MOBIL MERIDAN were battling 20-ft swells. By the 29th the system had lost it punch as it neared the coast of British Columbia.

The Korean storm, however, was still going strong on the 29th. This can be attested to by the KATORI MARU, sailing southeast of the 972-mb storm center, which was heading for the Bering Sea. Throughout the day the KATORI MARU reported winds in the 40-to 47-kn range in swells that ranged from 20 to 26 ft. And she was not alone. The NEW INDEPENDENCE and the CHASTINE MAERSK were among the other vessels that sent reports while battling the storm. Once over the Bering Sea the LOW began to fill.

Tropical Cyclones-- While eastern North Pacific storms are very rare this month, occasionally one will develop over the western ocean. Since 1959 there have been 22 tropical cyclones in the west during April; 16 of these have reached typhoon strength.

This April typhoon Ken was added to this list. Ken developed on the 24th just south of Woleai Is. in the Carolines. He reached tropical storm intensity on the 26th southeast of Yap Is. Near Saipan early on the 27th the JKNA reported 35-kn winds. A few hours later Ken was at typhoon strength some 60 mi southeast of Yap. At 1200 Ulithi Atol was reporting 30-kn east southeasterlies. The typhoon continued to intensify as it moved northward. At 0600 on the 28th Ken's was the first April typhoon since typhoon Cecil in 1979, the first ever western Pacific male. Ken held typhoon strength until the 29th, when he started to turn toward the northwest. Late the following day he dropped below tropical storm strength while meandering aimlessly along the 10th parallel.

Casualties -- Toward the middle of the month the 3-thousand ton SHINKO MARU carrying 38 passengers and 38 vehicles made contact with the 179-ton coaster CAMELIA MARU in dense fog near Ezaki Lighthouse, Awaji Shima. Both vessels suffered minor damage. On the 14th off Unimak Is., AK the stern trawler GOLD N SUN sank. She was approximately 12 mi northwest of Cape Sarichef, Unimak Is in about 300-ft of water. The crew of six were rescued with no injuries reported. The vessel allegedly foundered and sank as a consequence of heavy weather.

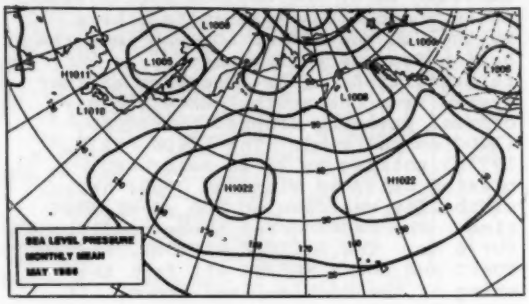


Figure 52. -- The double-centered subtropical high is featured.

May, 1986 -- As the usual the subtropical high dominated most of the North Pacific (fig. 52). However its northward bulge was more pronounced in the west, where a +4 mb anomaly extended to the Aleutians, and less pronounced in the Gulf of Alaska, where a -6 mb anomaly reflected an increase in storm activity. This increase is readily apparent on the storm track chart. The 700-mb mean indicated a general east northeasterly flow, becoming northeasterly near the Gulf of Alaska. In general the anomalies coincided with those at the surface -- the greatest being a -70m in the Gulf of Alaska.

On This Date -- May 26, 1960 -- Tropical storm Lucille moved close to Peel Island in the Philippines. Winds on the island were 50 kn with gusts to 70 kn. However, at this time the USS CAYUGA COUNTY was anchored in the harbor, which is open to the southwest. This harbor posses a bottle-necked shape, so that winds from the southwest quadrant are channeled and an increase in windspeed results. The CAYUGA COUNTY experienced winds of 75 kn, which caused the ship to broach.

Extratropical Cyclones-- In general storms tended to track from Japan and the Kuril Islands into the Bering Sea and, in some cases, into the Gulf of Alaska. The Sea of Okhotsk was also the scene of numerous cyclones throughout the month. About mid month a frontal system generated a tornado and heavy rains, which resulted in flash floods in Guangdong Province, China. On the 11th and 12th, it was reported, floods engulfed several mountain villages leaving 14 people dead and 3 seriously injured. A tornado and rainstorms sank 12 fishing vessels off Guangdong's southern coast, on the 10th, dumping 41 fishermen into the South China Sea. While 29 were rescued the 12 others were feared lost.

This storm came to life over the Sea of Japan on the 1st. Early on the 3d the EUCALY NO. 5 and the TATKEAWA MARU ran into winds of about 40 kn in seas around 15 ft. Both vessels were south of the 986-mb center. Gales were reported as the system made its way toward the Aleutians. On the 5th both the SAVU CAREER and the HARBOUR BRIDGE encountered 60-kn northerlies, the former 150 mi west of the center and the latter about 30 mi to the south southwest. Seas were running about 12ft. The following day the LOW turned southward and weakened. By the 7th it was over the Gulf of Alaska and rapidly filling.

Around mid month two short-lived storms caused some problems for shipping along the 40th parallel. One moved over and near Japan while the other flourished briefly along 160°W. Most of the action took place on the 15th and 16th. In the Sea of Japan and to the east of Honshu, ships like the SAMMICRYSTAL, LARISSA REISNER and the ANADYRLES were battling 35-to 45-kn winds in 10- to 12-ft seas. Across the ocean the BALDER, near the center of the storm (46°N, 157°W), at 0000 on the 15th, encountered 61-kn east northeasterlies in 12-ft seas. Several other vessels, including the DYUI KATTEGAT and the ASPEN, ran into 45-kn winds in 20-to 23-ft swells, on the 15th and 16th. By the 17th both storms had weakend considerably.

These two storms came to life within one day of each other. They came from different backgrounds, one west of Honshu, on the 19th, and the other just west of Midway Is on the 18th. They bumped into each other on the 22d and a brief but stormy marriage took place on the 24th (fig. 53) south of the Gulf of Alaska. The affair was attended by such vessels as the PACBARONESS, ORIENTAL EXECUTIVE, POTOMAC TRADER and TRIGGER. They all witnessed 40-kn winds while riding swells of 20 to 25 ft. The Japanese LOW sped across the Pacific in 4 days while the Midway storm moved steadily northeastward. East of the Kurils, pressure dropped to

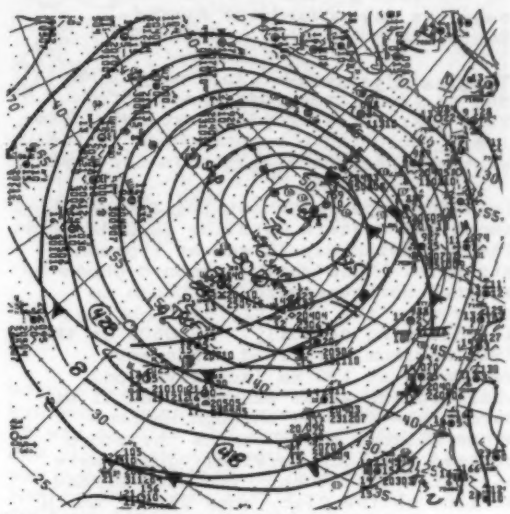


Figure 53. -- The marriage portrait; two as one at 0000 on the 24th.

973 mb on the the 21st. Winds of 35 to 50 kn were being reported south of the Honshu storm's center. Ship's like the RICHMOND BRIDGE and ASIAN HIGHWAY were helping to define the system's personality. At the same time the Midway storm had a central pressure of 996 mb, still in its formative stages. However within 24 hr it blossomed as the central pressure plummetted to 974 mb. This maturation was testified to by the SUNBELT DIXIE, TOKYO MARU and the SEALAND MARINER, which reported 35-to 45-kn winds in swells up to 16 ft. The honeymoon was short-lived, lasting all of 2 days. But for shipping it was a rough road. On the 25th the PALM ACE, PACBARONESS and the DYUI SKAGERAK all had winds in the 40-kn range in swells of 20 to 25 ft. They were all west and southwest of the merged center. By the 26th this union was starting to dissolve as a third party from the west entered the picture.

On the 27th a LOW developed just east of the Kuril Islands. It moved into

the Bering Sea and intensified. The ARCTIC TOKYO measured 40-kn winds in 20-ft seas near 54°N, 178°E on the 28th at 1200. Twelve hours later the ASIAN VENTURE ran into 42-kn winds in 21-ft seas near 53°N, 174°E. The storm's central pressure fell to 982 mb as it turned eastward during the day. The CENTURY HIGHWAY NO. 2 reported 35-kn southerlies in 12-ft swells at 0600. Gales were still being reported on the 30th as the now weakening system made its way toward the Alaska Peninsula.

Tropical Cyclones-- In a normal May one or two storms roam the Pacific. This year three tropical cyclones developed including a supertyphoon in the west and hurricane Agatha in the east.

Lola developed on about the 17th among the western Caroline Islands. The following day it was at typhoon strength. This early season typhoon started northwestward but began to recurve by the 21st(fig.54).Lola was intensifying steadily. By 0600 on the 19th maximum sustained winds were estimated at 130 kn (supertyphoon), while 100-kn winds extended out 25 mi. Before the day was through maximum winds climbed to 150 kn as the storm crossed the 15th parallel; gusts were estimated at 180 kn. The OSCO STREAM at 1200 on the 21st, some 250 mi north of the center, reported easterly 40-kn winds. Some 12 hr later her winds had increased to 55 kn and remained at that strength for several hours.

The ATLANTIC RAINBOW (27°N, 155°E) encountered 46-kn winds at 0600 on the 22d in swells that were running 20 ft. By 1200 the OSCO STREAM was experiencing 48-kn westerlies. By this time Lola's winds had decreased to 75 kn as the storm was turning extratropical and heading northeastward.

As Lola was fizzling out, tropical storm Mac was developing just east of Hainan in the South China Sea. For the first several days the depression moved eastward. On the 25th, as it passed through the Bashi Channel, tropical storm intensity was reached. Mac cruised the east coast of Taiwan on the 26th as winds reached a 45-kn peak. At 1200 the SHENG LI 4, in the Formosa St, reported a north northwest 37-kn wind. On the 28th Mac dropped to depression strength and headed eastward.

While Mac was coming to life in the South China Sea, across the ocean, Agatha was forming on the 22d.

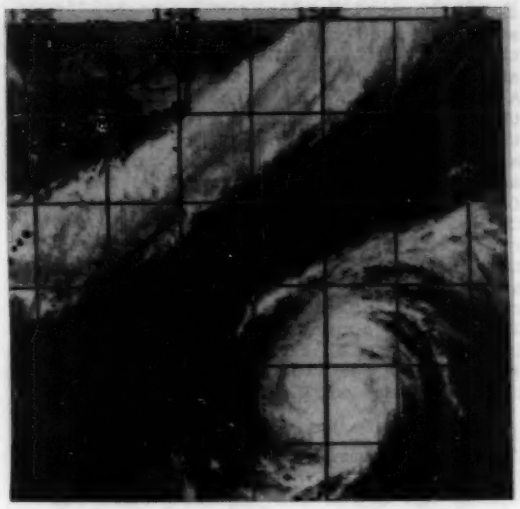


Figure 54. -- Supertyphoon Lola on the 21st.

Eastern North Pacific storms are uncommon in May, especially hurricanes, but Agatha did reach hurricane strength on the 26th and, for awhile, threatened to come ashore near Acapulco. However the storm turned southeastward and weakened that same day. Agatha paralleled the coast for the next few days before dissipating south of the Gulf of Tehuantepec on the 29th.

Casualties -- Eight people were confirmed drowned and 12 others given up for dead following the sinking of the 54-ton ferry FARIDA II off Mindanao Is, on the night of the 15th, in stormy seas. Thirty people were rescued off Sigayan Pt. The bulk carrier KIKUTA MARU No. 3, Kobe for Onahama, on the 24th, altered course to port and at the same time experienced strong southwesterly seas, shifting her cargo of copper ingots and left her listing about 40 degrees, some 21 mi from Irago-Misaki lighthouse.

June 1986 -- While this month's mean pressure chart (fig. 55) chart is not exactly a normal picture its pretty darn close. The subtropical high dominated a good portion of the ocean. The center was west of its normal positon, resulting in a +4 mb anomaly near 35°N, 170°W. The largest anomaly, was over the Aleutians, where a -7mb reading reflected an abundance of cyclones. The Gulf of Alaska

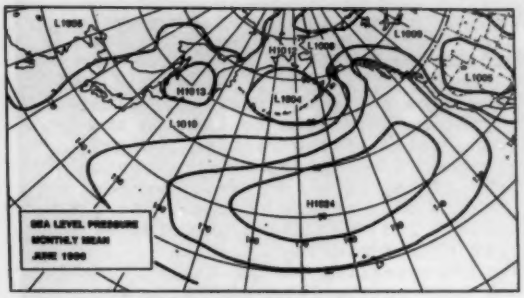


Figure 55. -- A fairly normal June in the Pacific.

pressure was a little higher than normal, although a number of cyclones made their presence felt. The 700 mb chart for the month, basically consisted of the subtropical high centered near 30°N, 170°W and the upper level Aleutian Low over the central Bering Sea. Between these systems a west to east flow was apparent across the central ocean with a southeasterly flow across the Gulf of Alaska and a northwesterly flow in the Sea of Okhotsk.

On This Date -- June 19, 1960 -- Typhoon Mary, or "Bloody Mary" as it came to be known, was the worst typhoon to hit Hong Kong in 23 yr. Maximum gusts reached 105 kn and over 14 in of rain fell in one 24-hr period. The typhoon left 18 thousand homeless and more than 100 dead. Harbor police reported more than 50 fishing vessels sunk.

Extratropical Cyclones-- This month's activity was mainly confined to a band between Japan and the western Gulf of Alaska and the Bering Sea. While there were no extreme storms, or monsters, gales were plentiful over the major shipping routes.

It began as an old fashioned shootout in the open Pacific, two storms battling for control, and ended in a mess in the Gulf of Alaska. The 985-mb Bering Sea storm was lazily patrolling its territory at 1200 on the 5th. From the west, the Philippines, rode a 995-mb greenhorn, to near 50°N, 175°W. The stage was set. Bystanders such as the LESSOGORSK (51°N, 166°E) and the PRESIDENT LINCOLN (45°N, 165° W) were witnessing the event in 35-to 40-kn winds. By 0000 on the 6th the

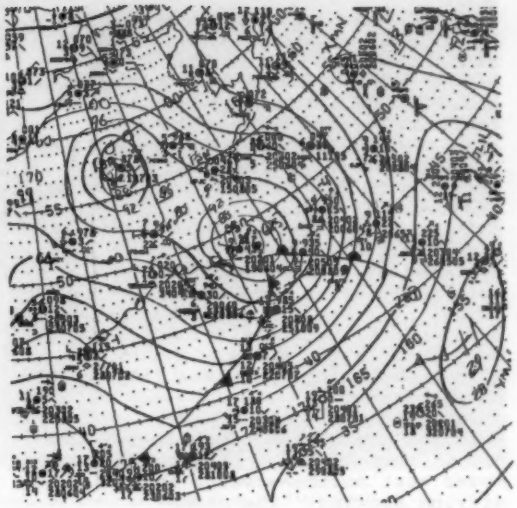


Figure 56. -- The contenders and the battlefield at 0000 on the 6th.

battle was in full swing as two systems fought for control (fig. 56). It was a quick and merciful victory for the greenhorn, which by 1200 was sporting a 978-mb center and honing in on new territory -- the Gulf of Alaska. The old timer lingered for a day in the Bering Sea. The KOREAN CEMENT II, at 0000 on the 7th, near 49°N, 155°W was fighting 49-kn westerlies and 25-ft seas. However the storm never got any tougher as pressure near its center rose to 985 mb by 1200. Its circulation, however, did claim the entire Gulf of Alaska for several days. At 1800 the ARCO SAG RIVER battled 52-kn easterlies near 59°N, 145°W. In general, reports of 35-to 45-kn winds and 12-to 18-ft seas were common through the 8th. However the following day the storm lost it and a messy situation involving several weak centers ensued -- a territorial battle with no clear cut winner, except the ships sailing the Gulf.

This storm developed east of Tokyo on the 6th and dissipated 11 days later northwest of San Francisco. It began as one of several waves along a stationary front. On the 10th, near 45°N, 170°W, it finally got organized. This was testified to by the NEPTUNE AMBER which sent in several reports; at 0600 her winds

were measured at 41 kn from the southeast, in 20-ft seas, near 46°N, 165°W. On the 11th as the storm turned sharply north northwestward, the VAN WARRIOR ran into 44-kn winds in 21-ft swells followed by the PRESIDENT TYLER, which recorded 42-kn winds in 20-ft swells. After crossing 50°N, the storm weakened and stalled. From the 12th until the 14th it rested but did not regain its strength. A few gales were reported by passing ships but nothing to write home about. Finally on the 14th it began moving eastward and reintensifying. This was short-lived however, and by the 15th a weakening storm was limping southeastward.

This LOW began as a frontal wave some 850 mi east of Tokyo on the 22d. It moved east northeastward, intensifying slowing. The JAPAN CARRYALL, some 240 mi southwest of the center, at 0600 on the 23d, encountered southerly winds at 37 kn in 10-ft swells. The ACT II, nearby in 12-ft swells, reported 36 kn. On the 24th the storm's central pressure dropped to 990 mb as it crossed the 45th parallel. At 1800 the BI JIN hit a 41-kn blow 250 mi southwest of the center. Several ships were encountering gales, including the MARITIME TRANSPORTER and the BO BENGTSSON. On the 25th the ASIAN VENTURE (44°N, 168°W), riding 20-ft swells, measured west southwesterlies at 40 kn in visibilities of less than 50 yd. The LOW, however, was caught in a squeeze between two HIGHs and weakening. By this time the storm was slowing and turning northward in the Gulf of Alaska. On the 38th the center moved across the Alaska Peninsula as it turned a counterclockwise loop. The JQUF (49°N, 139°W) at 0600 hit 39-kn southerlies. The following day, however, the system petered out in the central Gulf.

Tropical Cyclones-- The Pacific was the scene of four tropical cylones in June. Two of these, including a hurricane, developed in the east while two, including a typhoon, formed in western waters.

Blas was a very short-lived tropical storm that came to life on the 17th some 240 mi southwest of Clipperton Is. On the 18th it became a minimal tropical storm for a few hours before dropping back to a depression. The west northwestward moving system dissipated the following day.

Two days after the demise of Blas, typhoon Nancy came to life on the other side of the Pacific. Nancy reached tropical storm strength on the 22d at 0000 and was a typhoon before the day was through. At 1200 on the 23d the TENAGA SATU (21°N, 122°E) was picking up 40-kn southwesterlies in the Bashi Channel. At 0000 on the 24th the NEDLLOYD MARSEILLES (26°N, 121°E) was facing 52-kn northerlies. Nancy's maximum winds were estimated at 65 kn. This was down from an estimated 75-kn peak on the 23d. Nancy moved across eastern Taiwan during this time. This crossing took its toll and as the typhoon made its way through the East China Sea, it dropped to tropical storm strength. On the 25th the storm moved across northern Honshu and out into the Pacific. It was now becoming an extratropical storm. Gales were still common and being reported on the 26th by ships such as the MONCHEGORSK, YANA and the JAPAN CARRYALL. Swells were running about 15 ft. At 1200 on the 26th the CHANG HUI, some 350 mi west of the center, reported northwest winds at 58 kn. However in general the system was weakening.

While Nancy was battering Taiwan, Celia, in the east, was coming to life near 10°N, 98°W.(fig. 57). It was a tropical storm on the 26th at 0000. Ship reports were sparse, a situation that frequently handicaps Eastern Pacific Hurricane Center forecasters. Relying on satellite information, it was determined that Celia was turning northwestward and intensifying. Between 1200 and 1800 on the 27th the storm became hurricane. Its peak was 75-kn winds at 0000 on the 28th, however, the system was moving over cooler water. On the 29th it dropped below hurricane strength and by the 30th it was down to depression intensity.

On the 28th, while Celia was at its peak, Owen was developing in the Philippine Sea. As a tropical storm it began to recurve on the 29th. At 0000 on the 30th the TONGSAMUT (20°N, 133°E) encountered 50-kn northerlies; about 300 mi northeast of the center. By the 1st Owen had crossed the 20th

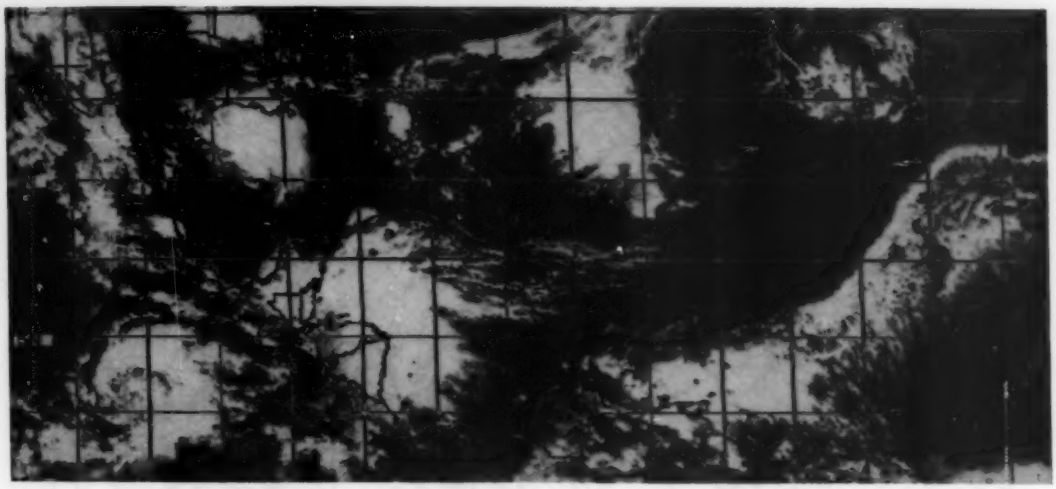


Figure 57. -- On the 25th Celia is coming to life (lower left) while hurricane Bonnie is moving in on the Texas coast.

parallel and was heading for the Ryukyu Is. However when the system arrived, it was a rapidly weakening depression.

Casualties -- The chemical tanker KOEI MARU NO. 8 collided with the cargo vessel CHUN NA about 6 mi from the lighthouse at the port of Ube, Yamaguchi Prefecture in dense fog on the 11th. On the 17th the research vessel HELIOS, 50 tons, was on passage from Shimizu to Haboro, Hokkaido, for investigation of octopus spawning conditions. The vessel was last heard from around Teuri Shima at 1700 local time. Weather conditions included dense fog with strong winds and rough weather. They had radioed that they were "considering to look for a suitable port of refuge as soon as possible". The following day an empty drifting lifeboat and some flotsam were spotted, but no sign of the crew of nine. On the 29th the JUNE 1 MARU, Iki-Ishida for Osaka, ran aground in dense fog near the Ukiiso light buoy.

MARINERS WEATHER LOG

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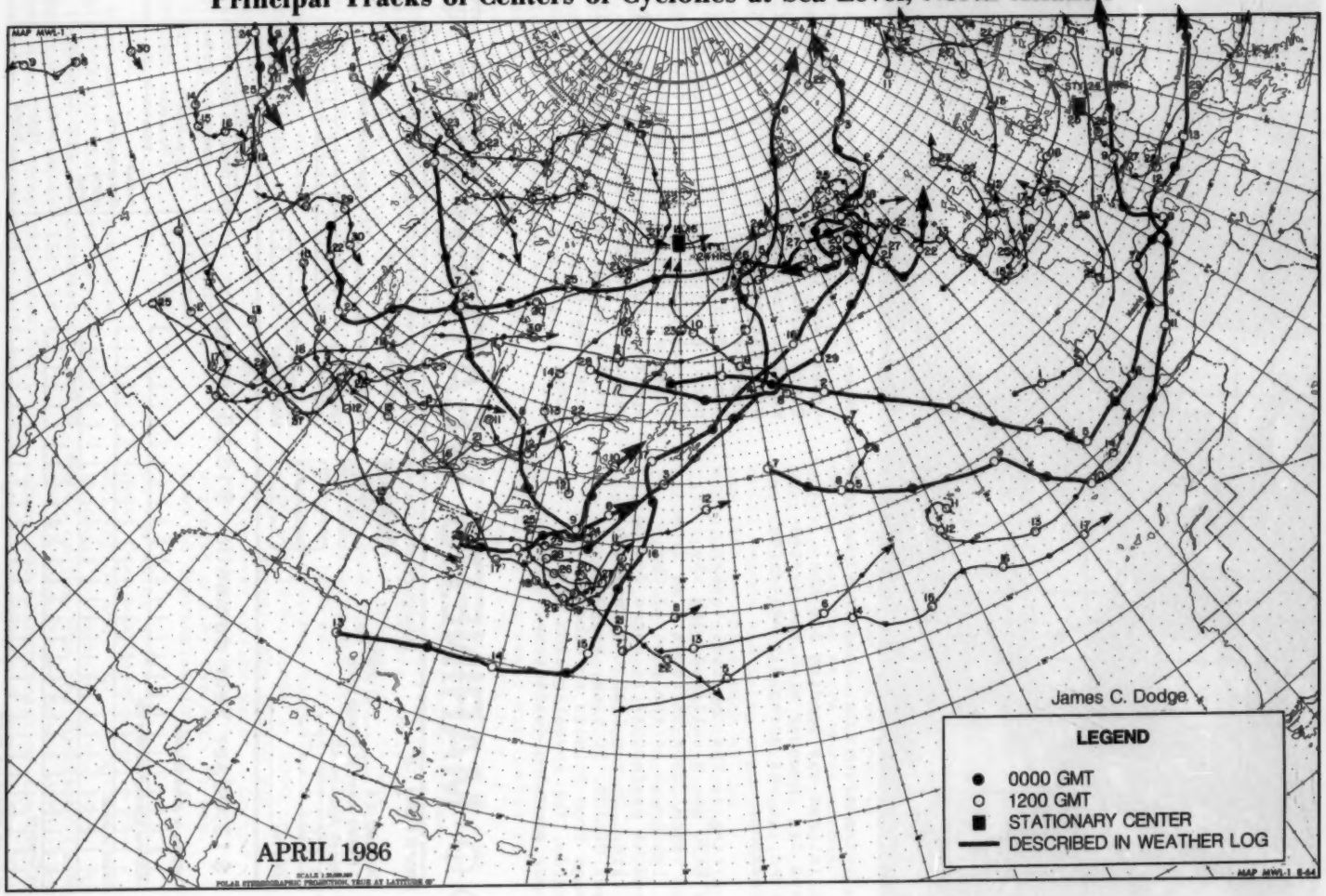
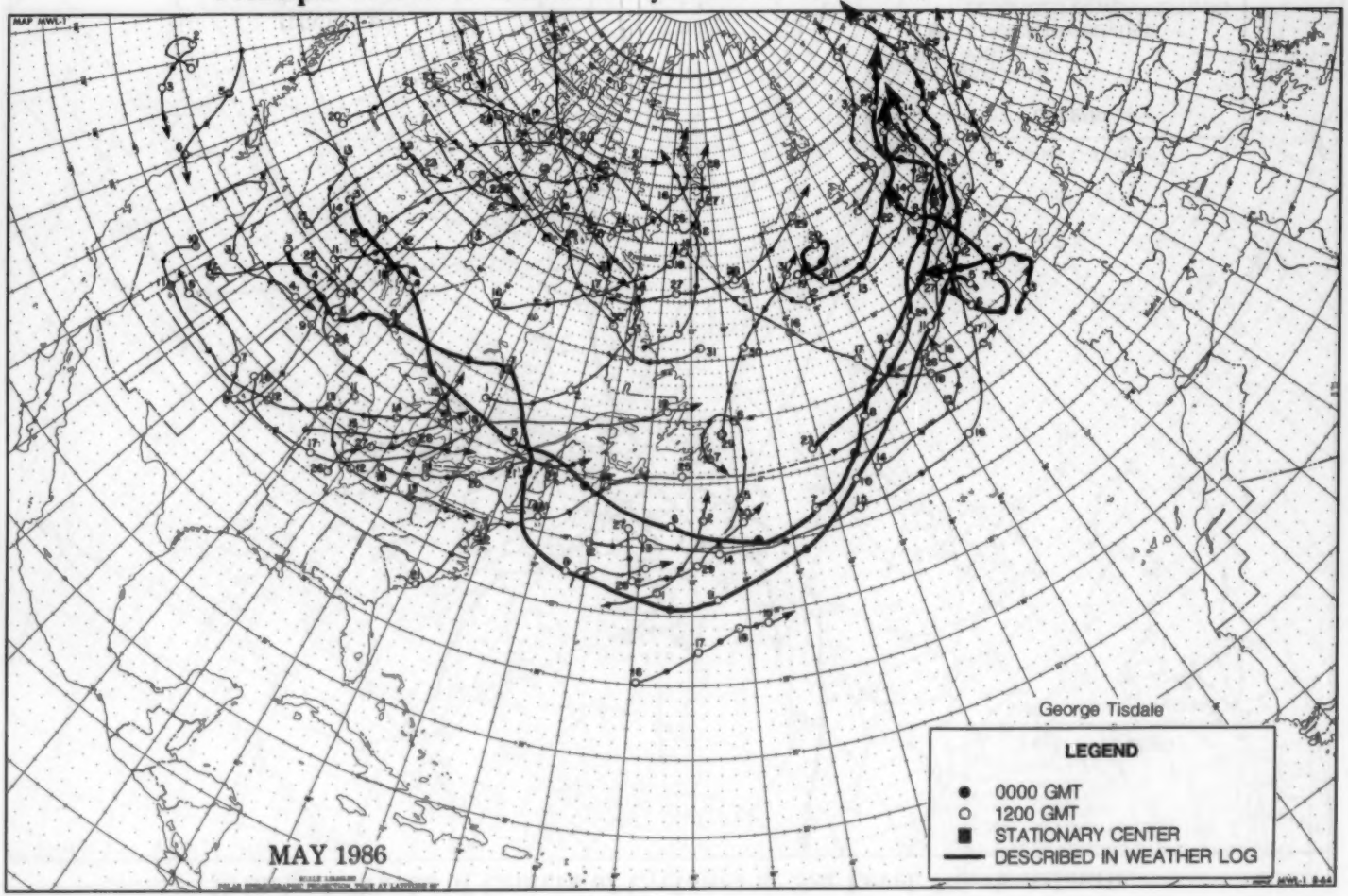
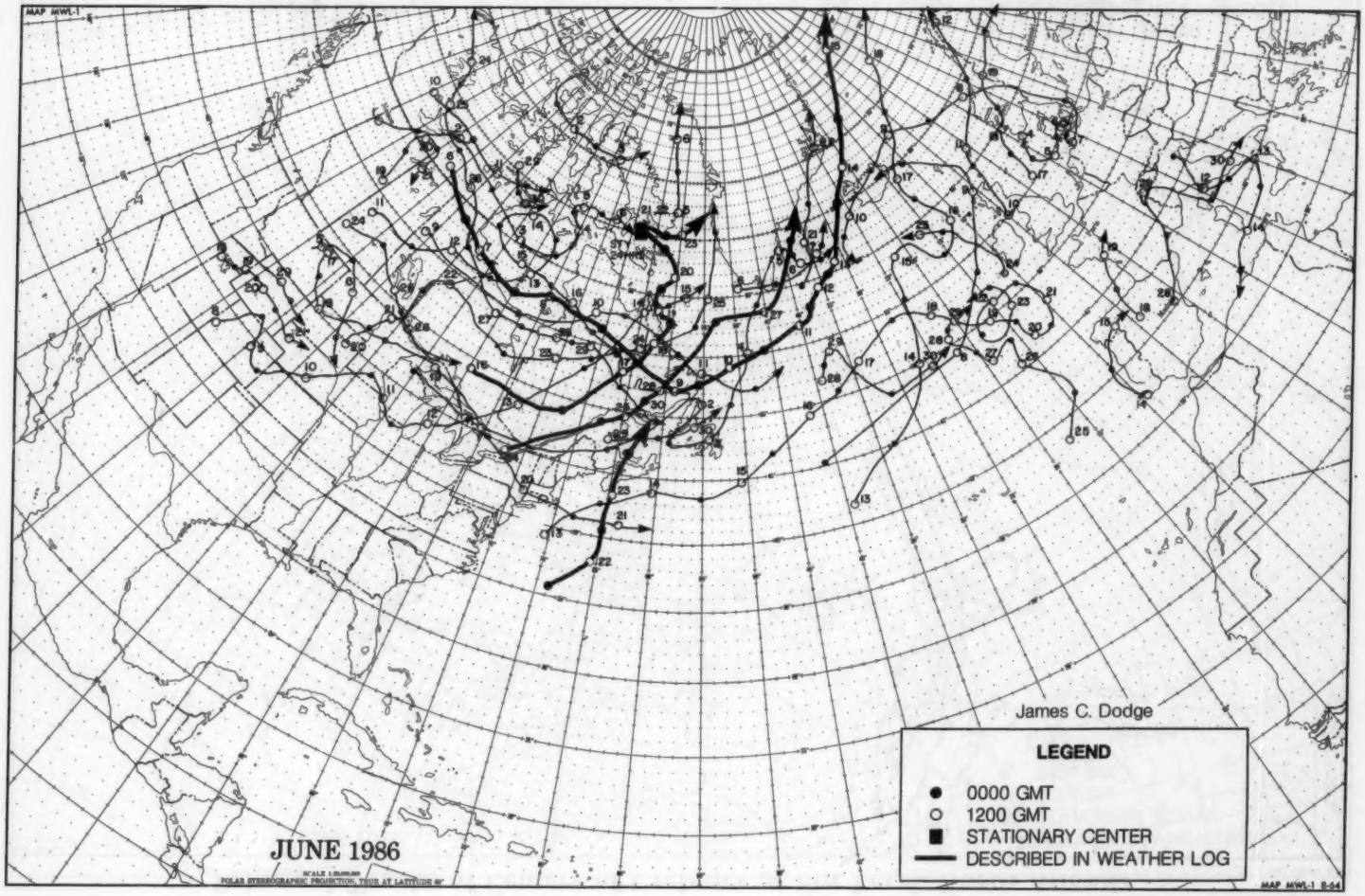
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



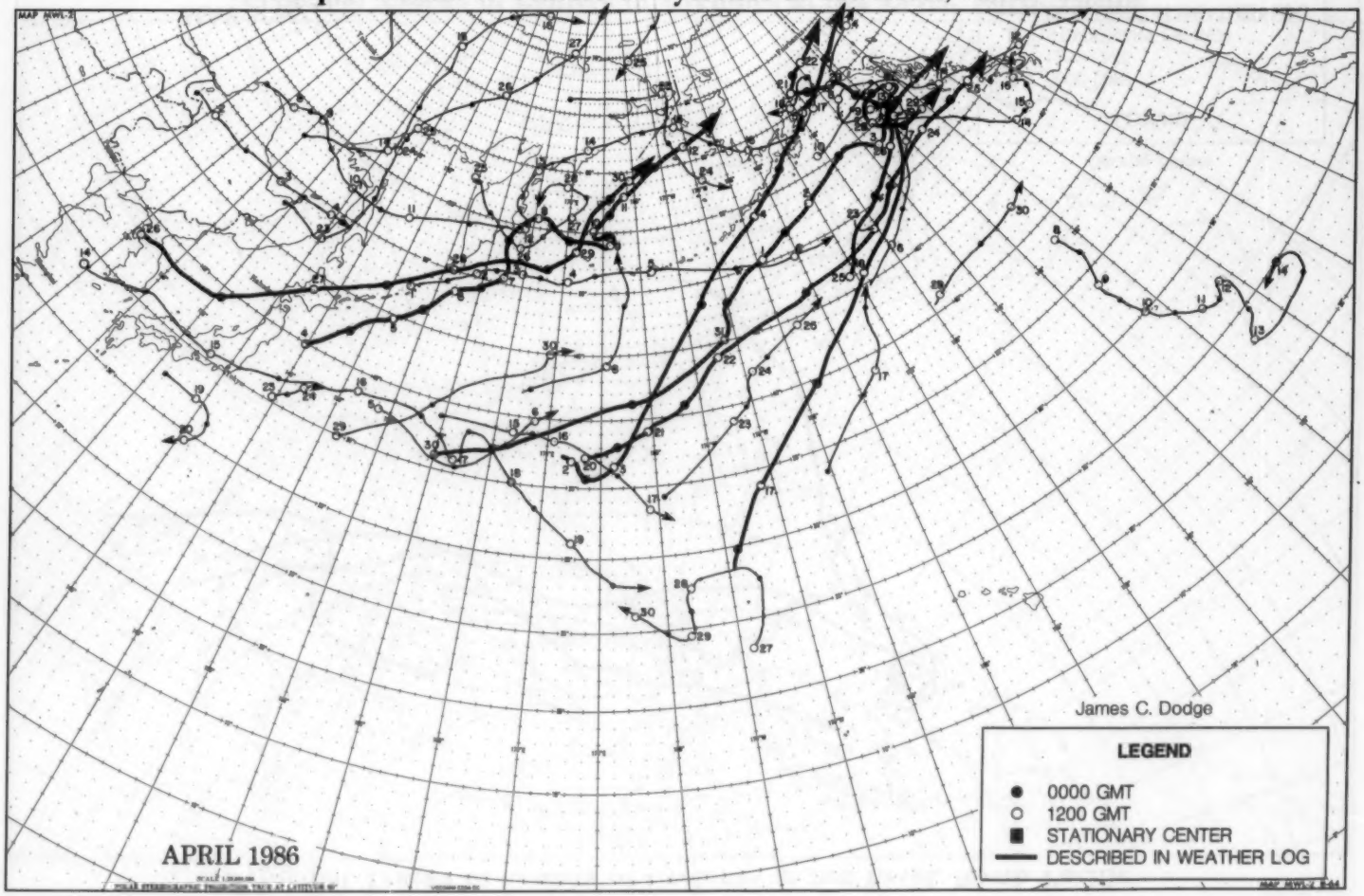
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



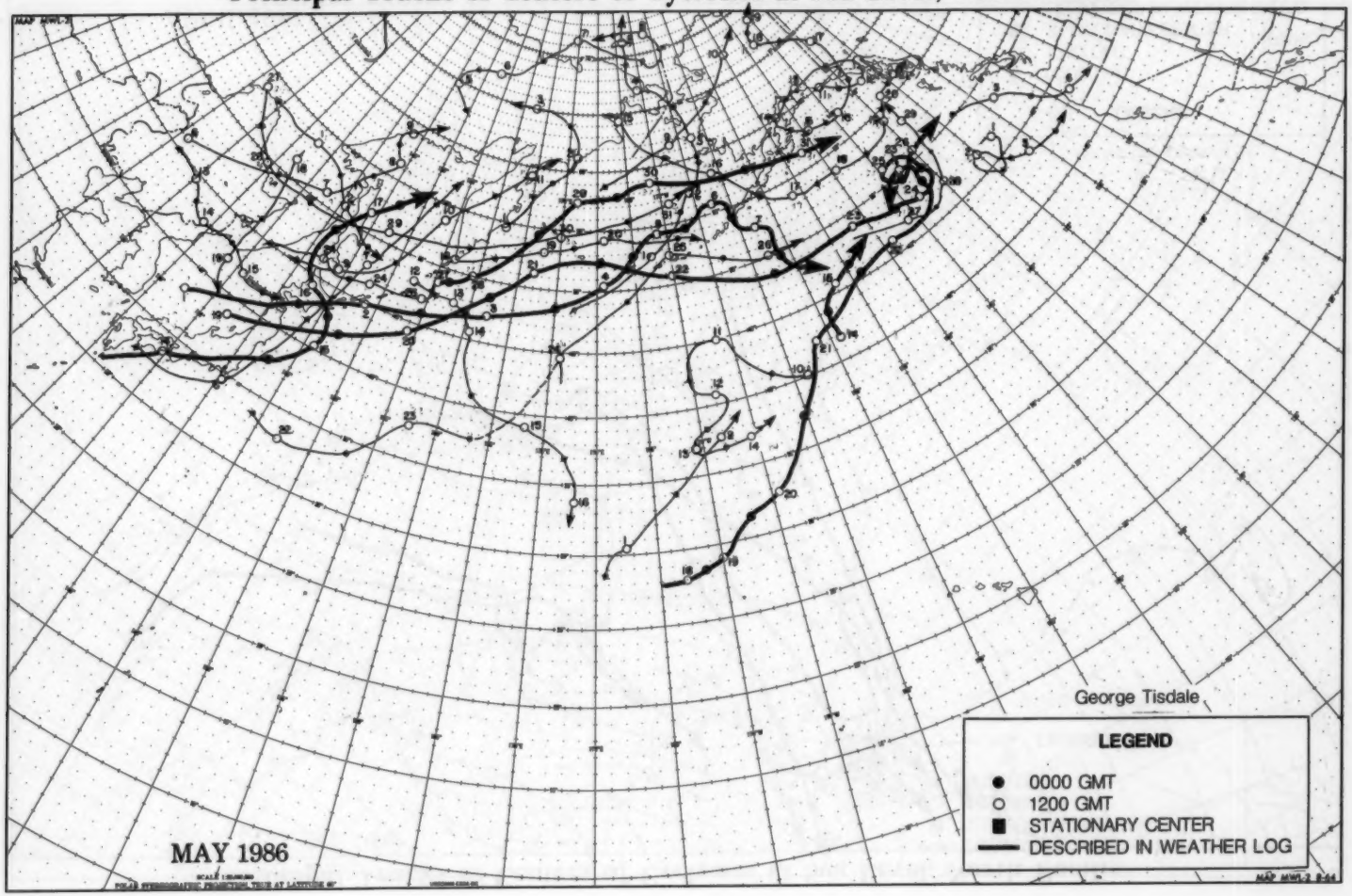
Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic



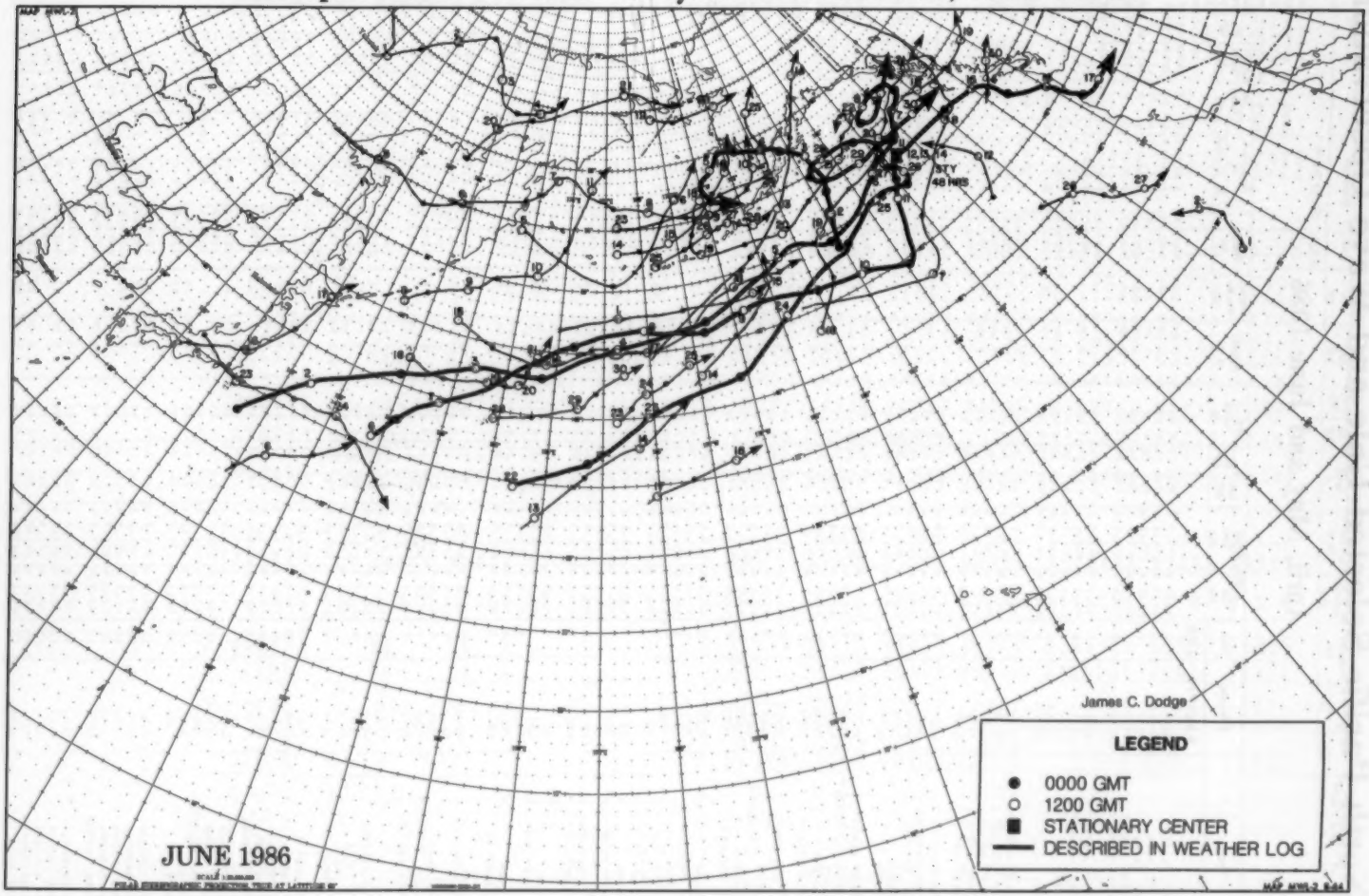
Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



Principal Tracks of Centers of Cyclones at Sea Level, North Pacific



North Pacific Selected Gale and Wave Observations

April, May and June 1986

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves†			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.*	Height ft.	
	PACIFIC	**APR**																
SEALAND PATRIOT	KHRF	1	42.5 N	177.7 W	00	31	N 42	5 NM	01	1003.9	5.5	3.0	5	14.5	31	7	26	
CAROLINE JANE	ELCN7	1	42.7 N	171.0 W	04	27	N 55	.5 NM	62	0986.5	8.0	9.5	10	24.5	27	10	24.5	
SEALAND PATRIOT	KHRF	1	42.2 N	175.3 W	06	30	N 42	5 NM	02	1007.9	8.0	1.8	5	11.5	31	7	26	
PRESIDENT MONROE	WNRD	1	41.6 N	163.9 E	06	16	42	2 NM	60	1001.2	7.9	9.8	8	19.5	12	10	19.5	
CHARLOTTE LYKES	WPHZ	1	43.6 N	152.6 E	08	25	48	2 NM	20	0993.0	3.3	2.0	8	19.5	26	8	13	
CHARLOTTE LYKES	WPHZ	1	43.3 N	152.3 E	12	26	48			0999.0	2.8	2.0	8	19.5	26	8	13	
PRESIDENT HOOVER	WTST	1	44.2 N	151.4 E	12	27	48	1 NM		0998.5	- 0.6	2.2	XX	23	27	XX	23	
MING MOON	BLMO	1	40.6 N	169.1 W	17	26	N 40			1011.0	9.0	13.0	7	19.5	11	8	18	
KENT	3EPF3	1	53.8 N	153.6 W	18	14	N 42	1 NM		1005.3	7.0	4.0	7	23				
CAROLINE JANE	ELCN7	1	43.0 N	157.0 W	18	27	N 53	1 NM	18	1007.5	8.0	11.0	10	29.5	27	12	29.5	
PRESIDENT HOOVER	WTST	1	43.6 N	150.5 E	18	28	42	5 NM		1006.5	0.0	2.2	XX	16.5	27	XX	19.5	
SEALAND FREEDOM	WGJW	2	45.3 N	153.9 E	06	29	N 45	5 NM		1000.0	0.0		6	16.5	26	11	19.5	
ADMIRALTY BAY	KACK	2	59.6 N	145.4 W	19	08	50	2 NM	07	1000.0	1.7	5.6	6	24.5				
BALTIMORE TRADER	KASJ	2	63.3 N	145.3 W	19	06	43	1 NM	73	1002.3	0.6	6.1	5	19.5	12	6	13	
ADMIRALTY BAY	KACK	3	58.8 N	149.3 W	00	08	50			0994.5	5.0	7.2	6	24.5				
PACIFIC VICTORY	H8ZO	4	52.2 N	156.9 W	18	21	N 40			0994.0	6.0	4.0	6	23				
COLORADO HIGHWAY	SMTS	5	54.1 N	152.9 W	00	23	N 45	2 NM	21	0989.5	5.0	4.5	7	13	22	11	23	
PACIFIC VICTORY	H8ZO	5	52.1 N	157.3 W	06	25	N 43			1001.0	5.0	4.0	10	26				
LAKE SUWA	DUEE	5	41.6 N	152.7 E	12	25	N 40	50 YD		0988.3	1.5	4.0	9	11.5	25	10	19.5	
LAKE SUWA	DUEE	5	41.7 N	154.5 E	18	24	N 40			0987.0	7.0	3.0	7	10	26	10	19.5	
PRESIDENT GRANT	WEZD	5	44.6 N	159.6 E	18	16	N 50	1 NM	10	0982.0	7.2	4.4	7	19.5	16	16	16.5	
PRESIDENT EISENHOWER	KRJG	5	49.3 N	156.9 E	21	08	N 54	.25 NM	75	0990.2	0.2	1.3	4	11.5	08	8	19.5	
LAKE SUWA	DUEE	6	42.0 N	156.3 E	00	23	N 41			0985.5	3.0	5.0	7	10	25	10	19.5	
LEDA MAERSK	OULU	6	42.6 N	150.0 E	00	30	40	.25 NM		0980.0	2.0		6	24.5				
CORNELIA MAERSK	OVPU	6	38.2 N	151.5 E	00	26	47	5 NM		1000.8	10.8		8	29.5	34	10	16.5	
ALASKA RAINBOW	3ECL4	6	43.0 N	153.5 E	06	26	N 54	200 YD	07	0975.0	1.0	2.0	12	19.5	26	12	21	
LAKE SUWA	DUEE	6	42.4 N	158.0 E	06	23	N 42			0982.5	6.0	5.0	7	10	24	10	19.5	
SEALAND LIBERATOR	KHRP	6	42.6 N	150.4 E	06	28	N 42	.25 NM	69	0983.6	2.0	2.1	6	16.5	28	11	23	
LEDA MAERSK	OULU	6	41.2 N	148.3 E	06	30	40	10 NM	07	0995.5	2.2		6	19.5				
ALASKA RAINBOW	3ECL4	6	42.8 N	153.2 E	12	27	N 52	200 YD		0982.0	1.0	5.0	11	19.5	27	11	21	
LAKE SUWA	DUEE	6	42.6 N	159.8 E	12	24	N 43			0984.5	6.3	4.0	7	10	24	12	23	
ALASKA RAINBOW	3ECL4	6	42.5 N	152.5 E	18	28	N 50	50 YD	03	0987.5	1.0	5.0	11	21	28	12	21	
LAKE SUWA	DUEE	6	42.9 N	151.6 E	18	23	N 42			0984.0	5.0	3.0	7	10	24	12	23	
PACIFIC ANGEL	7EXQ2	7	43.8 N	177.0 E	00	18	N 45	.5 NM		1001.3	8.3		3	6.5	18	6	21	
BUNGA MELAWIS	9MUT	7	48.0 N	179.0 E	00	14	45	.25 NM	45	1010.0	10.0	16.0	6	21				
LAKE SUWA	DUEE	7	43.2 N	163.4 E	00	23	N 40	1 NM		0986.0	7.0	3.0	6	13	23	10	19.5	
BUNGA MELAWIS	9MUT	7	40.2 N	179.8 W	06	17	40	.25 NM	61	1008.0	10.5	14.0	7	19.5	18	14	23	
MENINA BARBARA	DZTJ	7	53.2 N	149.3 W	06	36	40	.5 NM		1013.3	2.3	6.0	10	32.5	28	10	32.5	
PACIFIC VICTORY	H8ZO	8	52.7 N	178.4 W	00	20	N 41	10 NM	03	1001.5	6.0	4.0	8	19.5				
NOSAC EXPRESS	LNEJ	8	53.3 N	145.1 W	06	28	N 45	2 NM	86	1011.0	- 2.0	6.0	4	19.5				
UNICORN	DUJU	8	52.4 N	148.2 W	11	29	N 40	1 NM		1017.5	- 1.0	8.0	7	16.5	28	9	19.5	
NOSAC EXPRESS	LNEJ	8	53.5 N	146.5 W	12	28	N 45	2 NM	86	1014.3	- 1.5	6.0	4	19.5				
UNICORN	DUJU	8	52.5 N	145.4 W	17	27	N 40	5 NM		1021.0	2.0	8.0	7	16.5	29	9	21	
LAKE SUWA	DUEE	8	43.9 N	175.5 E	18	27	N 44	5 NM	16	0990.0	4.2	4.0	3	14.5	27	8	23	
NOSAC EXPRESS	LNEJ	8	53.6 N	147.5 W	18	28	N 45	5 NM	84	1017.5	1.5	5.0	4	19.5				
CORNELIA MAERSK	OVPU	8	44.8 N	174.6 E	18	29	52	2 NM		0985.3	2.8		12	28				
LUZON	3ESJ3	9	51.9 N	178.7 W	00	19	N 52	200 YD	45	0967.0	2.5	5.0	10	19.5	22	12	19.5	
PACIFIC ANGEL	7EXQ2	9	55.0 N	165.8 W	00	19	N 40	.5 NM		1011.0	10.3		3	5	09	3	19.5	
LAKE SUWA	DUEE	9	43.9 N	177.5 E	00	27	N 43	5 NM	18	0999.0	5.0	4.0	4	13	27	8	23	
CORNELIA MAERSK	OVPU	9	45.6 N	176.9 E	00	26	47	2 NM		0993.0	2.7		9	23				
LUZON	3ESJ3	9	52.1 N	177.2 W	06	20	N 52	200 YD		0967.6	3.0	5.0	10	19.5	21	12	19.5	
PACIFIC VICTORY	H8ZO	9	52.6 N	169.5 E	12	34	N 40	.25 NM	86	0975.0	3.0	2.0	9	29.5				
ARCTIC TOKYO	SLJT	9	54.0 N	175.0 W	23	17	N 40	2 NM	25	0988.0	4.0	4.0	6	19.5	17	6	19.5	
ARCTIC TOKYO	SLJT	10	53.8 N	178.1 W	06	18	N 45	2 NM	50	0982.0	3.0	3.0	6	19.5	17	6	19.5	
LOUIS MAERSK	OXMA	10	54.3 N	176.6 W	06	16	N 48	.25 NM		0987.1	9.8	9.0	10	29.5				
DYUT SKAGERAK	OUVB	10	49.8 N	175.5 W	12	18	N 46	2 NM	05	1019.0	6.0	6.0	6	16.5	18	11	21	
LOUIS MAERSK	OXMA	10	54.0 N	179.3 W	12	19	N 45	5 NM	80	0987.4	4.8		XX	29.5				
LOUIS MAERSK	OXMA	10	53.7 N	177.9 E	18	18	N 41	5 NM	84	0984.8	3.0	4.0	8	19.5				
NOSAC EXPRESS	LNEJ	11	54.4 N	173.2 W	00	18	N 45	1 NM		1003.0	5.0	4.0	10	19.5				
FLORIDA RAINBOW	3ETV3	11	36.3 N	154.4 E	18	18	N 45			1003.0		16.0	8	29.5	18	8	24.5	
POTOMAC TRADER	WXBZ	11	38.7 N	125.4 W	18	33	45	1 NM		1016.2	12.2		6	16.5	34	12	23	
JUATSINO SOUND	ELAW3	12	38.8 N	158.5 E	00	18	N 43	200 YD		1000.0	13.0		6	19.5	22	10	23	
EXXON NEW ORLEANS	WNDM	12	47.2 N	131.6 W	00	31	N 56			1007.5	9.5	10.0	6	6.5	29	10	21	
LILLOOET	DGRL	12	46.0 N	131.2 W	03	31	45	1 NM	16	1011.0	7.2		11	19.5				
LILLOOET	DGRL	12	46.1 N	131.1 W	06	34	45	2 NM	62	1013.0	6.2		12	23				
CHEVRON OREGON	WAHL	12	43.9 N	128.7 W	12	30	N 42	5 NM	02	1014.0	9.4		7	13	30	9	21	
MENINA BARBARA	DZTJ	12	53.2 N	173.2 E	18	22	40	1 NM	12	0990.7	5.0	3.0	9	23	26	9	26	
POTOMAC TRADER	WXBZ	12	41.7 N	127.8 W	18	33	50	5 NM	15	1018.6	11.1		14	41	34	14	41	
MENINA BARBARA	DZTJ	12	53.0 N	171.9 E	23	25	41			0996.1	4.0	3.0	12	24.5	25	10	26	
KEYSTONE CANYON	KSFK	13	40.9 N	127.3 W	00	33	N 40	10 NM		1022.8	11.1	11.7	5	10	33	12	23	
NOSAC EXPRESS	LNEJ	13	52.3 N	166.9 E	00	22	N 51	.5 NM		0991.0	3.0	4.0	15	41				
POTOMAC TRADER	WXBZ	13	42.3 N	127.9 W	00	33	45	5 NM	81	1021.5	9.4		12	36	34	12	36	
MENINA BARBARA	DZTJ	13	52.9 N	173.3 E	06	25	41			0998.2	3.0	3.0	9	26	25	10	29.5	
KEYSTONE CANYON	KSFK	20	56.1 N	141.0 W	00	22	N 50	2 NM	07	0980.0	5.0	5.6	6	14.5	22	10	19.5	
PHILADELPHIA	WJBO	20	55.2 N	140.4 W	00	21	N 40	5 NM	02	0985.5	7.8	4.4	6	16.5	21	10	32.5	

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves*			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.*	Height ft.
	PACIFIC	**APR**																
KEYSTONE CANYON	KSFK	20	55.6 N	143.2 W	06	24	N 45	2 NM	11	3998.0	3.9	5.6	5	13	23	12	29.5
NUESTRA SENORA DEL POSA	DVLO	21	13.5 N	95.6 W	05	36	45	2 NM		1013.0	26.0	28.0	10	23	36	10	29
MARGARET LYKES	KRJL	21	40.0 N	179.2 E	12	09	40	2 NM	62	1010.0	10.0	7.0	8	19.5			
NUESTRA SENORA DEL POSA	DVLO	21	12.7 N	93.9 W	17	36	45	2 NM		1012.0	25.0	26.0	6	23	36	10	23
MARGARET LYKES	KRJL	22	43.1 N	174.8 E	00	06	41	2 NM	55	1007.3	8.3	7.0	8	18	09	8	19.5
MARGARET LYKES	KRJL	22	40.1 N	172.7 E	06	02	40	10 NM		1013.8	6.1	8.0	6	16.5	03	10	21
MARGARET LYKES	KRJL	22	39.9 N	168.3 E	18	01	47	10 NM	25	1021.2	3.9	7.0	5	13	04	10	21
CHEVRON OREGON	WNHL	23	38.3 N	123.7 W	06	31	N 43	18 NM		1014.9	10.6		5	10	31	8	21
OVERSEAS JUNEAU	WWND	23	39.0 N	124.5 W	05	33	50	5 NM	01	1015.0	10.6	10.0	4	10	33	12	23
OVERSEAS JUNEAU	WWND	23	39.7 N	124.9 W	12	34	50	5 NM		1015.9	13.6	10.0	4	13	34	8	23
OVERSEAS JUNEAU	WWND	23	40.5 N	125.5 W	18	34	50	10 NM		1019.8	12.8	10.6	4	11.5	35	8	23
SEALAND MARINER	KGJF	24	51.8 N	141.2 W	12	31	N 66	5 NM	25	0988.0	4.4		8	26			
PRINCE OF TOKYO	ABSJ	24	51.6 N	138.5 W	13	29	N 46	1 NM	81	0987.0	6.5	6.0	17	28	29	17	28
BALTIMORE TRADER	KASJ	24	54.9 N	136.7 W	18	11	45	10 NM		0986.0	5.0	7.2	5	19.5	16	5	16.5
GALVESTON	KBGA	24	49.9 N	128.0 W	18	14	45	2 NM	65	0999.0	6.1	10.0	6	13	16	9	24.5
SEALAND MARINER	KGJF	24	51.4 N	143.2 W	19	32	N 50	5 NM	16	1004.8	3.9		9	24.5			
PRESIDENT HOOVER	WTST	24	49.8 N	136.5 W	18	29	50	1 NM	60	0991.2	5.6	8.3	8	24.5	29	12	24.5
PRINCE OF TOKYO	ABSJ	25	51.5 N	138.8 W	00	30	N 43	1 NM	18	0997.5	6.5	6.0	17	28	30	18	29.5
PRESIDENT HOOVER	WTST	25	49.6 N	133.4 W	00	29	43	2 NM	61	0994.4	6.7	8.3	8	32.5	29	12	34.5
OVERSEAS JUNEAU	WWND	25	47.4 N	130.4 W	00	28	50	2 NM	16	1000.0	10.0	8.3	5	19.5	28	10	29.5
LAKE SUWA	DUEE	25	50.1 N	133.9 W	06	29	N 49	200 YD	60	0996.0	5.0	7.0	8	14.5	29	10	19.5
OVERSEAS JUNEAU	WWND	25	48.3 N	131.0 W	06	28	55	2 NM	07	1001.6	8.3	7.4	5	19.5	28	10	32.5
OVERSEAS JUNEAU	WWND	25	49.4 N	131.9 W	18	31	40	10 NM	20	1008.9	9.4	7.8	5	19.5	31	10	29.5
PRINCE OF TOKYO	ABSJ	26	52.6 N	145.1 W	06	08	N 40	.5 NM	80	0988.0	6.0	5.0	15	24.5	08	15	24.5
SKAUGRAN	LMUK	27	52.3 N	139.1 W	00	25	N 54	2 NM	40	0989.0	5.0	8.5	7	18	27	12	19.5
ARCO JUNEAU	KSSG	27	57.1 N	143.2 W	18	08	N 45	.5 NM	59	0988.2	5.0	5.5	3	6.5	09	10	19.5
BONITA	ELAN2	28	26.5 N	179.2 E	00	15	N 42	10 NM		1015.5	21.0	24.0	7	19.5	02	14	23
SKAUGRAN	LMUK	28	52.9 N	143.0 W	00	28	N 42	2 NM	62	1003.0	4.5	8.5	8	16.5	27	14	19.5
PRESIDENT WILSON	WNPD	28	49.4 N	142.1 W	00	27	40	5 NM	02	1012.5	5.5	6.7	7	14.5	28	12	19.5
MOBIL MERIDIAN	KBSM	28	57.1 N	140.6 W	06	07	42	5 NM	07	1000.1	6.1	4.4	3	6.5	10	8	19.5
PRESIDENT WILSON	WNPD	28	49.2 N	143.3 W	12	31	40	10 NM	27	1018.0	4.4	7.2	5	10	31	8	19.5
NEW INDEPENDENCE	SMOS	29	48.3 N	167.9 E	00	22	N 48			0987.5	3.5	2.0	8	24.5	21	15	29.5
NEW INDEPENDENCE	SMOS	29	48.4 N	169.9 E	06	27	N 44			0993.0	3.0	7.0	6	23	24	9	26
CHASTINE MAERSK	OWCY	29	52.2 N	174.2 E	18	26	40	5 NM	03	0999.2	3.2		15	23			
TYSON LYKES	WSCJ	30	39.9 N	141.5 W	06	27	60	1 NM	62	0992.1	11.1	10.0	11	39	28	10	34.5
TYSON LYKES	WSCJ	30	39.7 N	142.6 W	12	29	60	2 NM	58	1004.3	9.4	10.6	11	39	28	10	34.5
TYSON LYKES	WSCJ	30	39.3 N	143.8 W	18	31	50	5 NM	25	1012.5	10.6	10.0	8	23	31	12	34.5
	PACIFIC	**MAY**																
TONSONIA	KJDG	2	50.3 N	131.8 W	00	11	N 48	2 NM					5	10	10	5	19.5
TONSONIA	KJDG	2	48.9 N	130.3 W	06	14	N 48	2 NM					4	11.5	14	6	21
LYUI KATTEGAT	DUPC	15	43.3 N	171.4 W	06	05	N 44						6	19.5	04	7	19.5
ASHEN	KACK	16	50.0 N	142.8 W	18	09	45	2 NM	54				8	16.5	09	10	23
TONSONIA	KJDG	17	57.5 N	141.7 W	06	20	N 50	2 NM					4	10	17	6	19.5
MARGARET LYKES	KRJL	18	28.9 N	176.1 W	06	05	40	2 NM	21				9	19.5	05	9	19.5
ATLANTIC RAINBOW	AGTF	22	26.7 N	155.2 E	06	13	N 46	1 NM	21				7	11.5	18	10	19.5
LYUI SKAGERAK	DUVR	22	44.8 N	148.0 W	06	21	N 46	2 NM					9	21	17	12	23
ATLANTIC RAINBOW	AGTF	22	26.6 N	156.1 E	12	18	N 64	1 NM	21				7	11.5	18	11	24.5
ATLANTIC RAINBOW	AGTF	22	26.6 N	156.2 E	18	22	N 48	1 NM	07				12	32.5	18	20	42.5
SEALAND ENDURANCE	KGJX	23	33.7 N	165.8 E	07	20	N 40	5 NM	02	1002.0			5	8	19	8	19.5
KEYSTONE CANYON	KSFK	23	47.3 N	131.1 W	12	15	40	2 NM	63						15	XX	19.5
LYUI SKAGERAK	DUVR	23	47.2 N	161.4 W	18	33	N 40	.5 NM	65				8	19.5	29	16	19.5
AMERICAN VIRGINIA	WPVR	23	38.9 N	153.4 W	18	27	N 40	10 NM	02	0992.5			3	10	27	6	19.5
POTOMAC TRADER	WXRZ	23	53.2 N	139.2 W	18	12	40	5 NM	07				4	10	12	8	24.5
PACBARONESS	SLFX	24	49.5 N	153.3 W	00	02	N 42	.5 NM	48				8	16.5	03	10	19.5
TRIGGER	FLPW	24	42.9 N	161.5 W	06	29	N 42	2 NM					7	13	29	9	19.5
PACBARONESS	SLFX	25	51.2 N	140.0 W	00	02	N 40	.5 NM	48				8	16.5	01	10	19.5
LYUI SKAGERAK	DUVR	25	48.6 N	175.1 W	06	21	N 42	1 NM		0991.0			10	16.5	05	16	19.5
LYUI SKAGERAK	DUVR	25	48.6 N	179.2 W	18	29	N 44	.25 NM		0999.0			10	16.5	26	12	21
ARCTIC TOKYO	SLJT	26	53.6 N	177.5 E	12	19	N 40	2 NM	60				6	19.5			
ASIAN VENTURE	3CIP3	29	53.3 N	174.0 E	00	26	N 42	2 NM					10	21	26	10	21
	PACIFIC	**JUNE**																
NATIONAL PRIDE	DZPX	3	42.5 N	134.0 W	00	05	N 40	5 NM		1016.0	14.5	14.0	9	21	05	10	23
NEPTUNE AMBER	S6CY	10	46.0 N	164.8 W	06	14	N 41	1 NM	80	1002.0	8.5		7	19.5	13	9	16.5
VAN WARRIOR	ELDA8	11	50.1 N	151.8 W	12	12	N 44	.5 NM	61	1000.0	8.0	6.0	8	16.5	10	11	21
PRESIDENT TYLER	WEZH	11	50.0 N	149.2 W	18	14	N 42	2 NM	63	1003.2	8.9	5.6	5	11.5	12	8	19.5
ASIAN VENTURE	3CID7	25	44.4 N	168.0 W	00	25	N 40	< 50 YD		1004.5	10.0	7.0	12	16.5	25	12	19.5

North Atlantic Selected Gale and Wave Observations

April, May and June 1986

Vessel	Nationality	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10°	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C Air	Temperature °C Sea	Sea Waves? Period sec.	Sea Waves? Height ft.	Swell Waves Dir. 10°	Swell Waves Period sec.*	Swell Waves Height ft.
ATLANTIC APR																	
AMERICAN PURITAN	KRGB	2	42.9 N	36.6 W	06	28	N 40	10 NM	02	1009.5	10.6	13.3	7	16.5	27	12	19.5
TFL EXPRESS	9VPU	14	49.0 N	19.2 W	18	34	41	10 NM	80	1003.0	9.5	12.6	10	16.5	35	15	19.5
TFL ENTERPRISE	9VVD	15	49.9 N	20.0 W	12	33	N 47	5 NM		1006.5	10.0	10.0	9	26	33	10	29.5
SEALAND VOYAGER	KHPK	15	39.8 N	58.5 W	23	19	42	5 NM	03	0991.4	20.6	23.-	7	8	19	7	24.5
SEALAND VOYAGER	KHRK	16	40.8 N	53.4 W	12	16	44	2 NM	81	1002.6	17.8	20.-	7	10	15	6	26
ATLANTIC	FLAJA	19	37.6 N	71.8 W	00	36	45	2 NM		1010.5	15.0	17.0	9	19.5			
PERSISTENT TAGOS 6	WFSJ	19	55.8 N	34.3 W	12	31	N 40	2 NM	84	0990.0	4.3	6.7	5	19.5	32	10	28
RAINBOW HOPE	KNDB	20	57.9 N	32.9 W	06	27	44	2 NM		0989.1	5.0		5	11.5	32	10	24.5
TFL DEMOCRACY	9VPR	20	48.7 N	22.8 W	18	30	40	5 NM	81	1002.1	5.7	11.0	7	6.5	31	13	19.5
RAINBOW HOPE	KNDB	21	55.7 N	35.6 W	00	32	40	10 NM	02	1008.2	3.9		XX	10	32	20	32.5
RAINBOW HOPE	KNDB	21	55.3 N	37.4 W	06	32	45	5 NM		1014.9	2.8		6	11.5	32	10	19.5
SEALAND PRODUCER	WJBJ	22	48.0 N	21.1 W	00	29	50	10 NM	80	1005.0	10.0	8.9	6	24.5	32	12	28
AMERICAN SKY	WHBG	22	44.0 N	23.8 W	11	32	40	5 NM		1018.5	11.7	13.3	6	10	32	8	19.5
AMERICAN SKY	WHBG	22	46.7 N	22.8 W	18	32	40	5 NM	02	1016.0	10.6	13.3	6	10	32	10	26
ATLANTIC MAY																	
CYUI SKAGERAK	DUVB	6	39.3 N	71.8 W	20	21	N 44	5 NM					6	16.5	21	10	23
CYUI SKAGERAK	DUVB	6	37.6 N	72.2 W	06	21	N 40	10 NM					6	19.5	21	14	19.5
CYUI SKAGERAK	DUVP	6	36.4 N	72.4 W	12	23	N 48	5 NM	07				6	16.5	23	14	23
CYUI SKAGERAK	DUVE	6	34.7 N	72.9 W	18	22	N 42	5 NM	07				7	16.5	22	14	21
AMERICAN EAGLE	WFPJ	6	48.0 N	31.0 W	12	19	42						5	18	18	6	21
CLARA MAERSK	OWIK	8	44.7 N	29.4 W	18	23	40	5 NM	02				4	10	22	10	19.5
AMERICAN EAGLE	WFPJ	8	47.5 N	31.7 W	18	21	45	2 NM	18				7	24.5	18	8	29.5
BORINQUEN	KPCV	10	38.0 N	72.6 W	19	05	N 40	10 NM	02				8	19.5	09	10	19.5
FRANCES HAMMER	KHCG	11	37.0 N	67.7 W	12	35	42	2 NM	81				4	8	04	8	19.5
ITALICA	IUML	12	41.2 N	62.2 W	06	08	N 45						10	26			
STELLA LYRES	KHJA	12	35.5 N	11.2 W	06	36	40	10 NM	02				4	16.5	04	12	26
TFL FREDOM	9VXX	12	40.6 N	66.1 W	12	05	N 41	2 NM	51				12	23	14	14	26
TFL FREEDOM	9VXX	12	39.8 N	67.7 W	18	36	N 45	1 NM					12	16.5	02	15	26
AMERICAN EAGLE	WFPJ	12	40.5 N	66.1 W	19	04	40	2 NM	55				7	19.5	04	8	29.5
STAR OF TEXAS	KADM	17	49.3 N	12.7 W	10	17	40	.5 NM	46				6	10	15	10	26
SEALAND PRODUCER	WJBJ	19	46.9 N	25.5 W	12	32	40	10 NM	15				6	13	33	6	19.5
ATLANTIC JUNE																	
TFL DEMOCRACY	9VPR	10	39.0 N	53.7 W	00	23	40	5 NM		1014.0	22.5	23.5	7	11.5	23	8	19.5

BATHY-TESAC Data Received at NMC

April, May and June 1986

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
ACT6	2	2	0	***
AMCT	7	7	0	***
A8QS	1	1	0	ATLANTIC
A8YI	8	8	0	PACBARON
BNDN	32	32	0	***
BNSC	2	2	0	XIANG YANG HONG 16
CGDG	59	29	30	HUDSON
CGDV	285	285	0	W. TEMPLEMAN
CSBL	3	3	0	***
C7C	193	0	193	OCEAN STATION CHARLIE
C7L	134	134	0	OCEAN STATION LIMA
DBBF	2	2	0	WEGA
DBBX	84	84	0	GAUSS
DBFJ	9	9	0	FRITHJOF
DBFR	150	150	0	ANTHON DOHRN
DBLK	53	53	0	POLARSTERN
DCH	9	9	0	ELBE I
DCL	2	2	0	FEHMARNBELT-FEUERSCHIFF
DDMA	13	13	0	JEBSEN SOUTHLAND
DESI	57	57	0	VALDIVIA
DGEM	5	5	0	ELBE
DGFR	34	34	0	MONTE OLIVIA
DGLM	37	37	0	MONTE ROSA
DGLV	2	2	0	***
DGRL	82	82	0	RIKA
DGVK	60	60	0	COLUMBIA VICTORIA
DGZV	83	83	0	COLUMBUS VIRGINIA
DHCU	40	40	0	UBENA
DHCW	56	56	0	COLUMBUS WELLINGTON
D5CW	2	2	0	SOUTH GLORY
D5NZ	53	53	0	POLYNESIA

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
EKPC	10	10	0	LENGK
ELBX3	17	17	0	PACKING
EI DWB	22	22	0	***
EREA	74	49	25	MONSOON
EREB	239	83	156	VOLNA
EREH	50	0	50	PRIBOI
EREI	59	28	31	OCEAN
ERES	125	81	44	VICTOR BUGAEN
ERET	114	93	21	GEORGE OUSHAKOV
EREU	76	72	4	ERNST KRENKEL
ESGG	105	50	55	FROLOV VYACHESLAV
EVPW	1	1	0	SULOY
FNBF	3	3	0	ROSTAND
FNBG	2	2	0	CAPRICORNE
FNCW	35	35	0	ROUSSEAU
FNFU	14	14	0	EL MANSOUR
FNGB	35	35	0	MARION DUFRESNE
FNGS	41	41	0	LAFAYETTE
FNOM	33	33	0	ANGO
FNPA	2	2	0	***
FNUB	1	1	0	CAMARGUE
FNXE	46	46	0	RODIN
GACA	16	16	0	***
GOTC	15	15	0	CALIFORNIA STAR
GOVL	29	29	0	ACT 4
GOVM	74	74	0	DILKARA
GOVN	16	16	0	ACT6
GZKA	8	8	0	ACT 3
HCGT	24	24	0	BUCCANEER
HCJH	7	7	0	ISLA FLOREANA
HPAN	11	11	0	MICRONESIAN COMMERCE

CALL SIGN	TOTAL	BATHY	TESAC	SHIP NAME
HPEW	44	44	0	PACIFIC ISLANDER
H9BQ	19	19	0	MICRONESIAN INDEPENDENCE
JBES	87	87	0	YAMASHIN MARU
JBMS	38	38	0	HIKAWA MARU
JBOA	37	37	0	KEIFU MARU
JCDF	52	52	0	SOYO MARU
JCDT	12	12	0	AMERICA MARU
JCIN	2	2	0	TOKYO MARU
JCLL	42	42	0	LIONS GATE BRIDGE
JCOD	22	22	0	SHOYO
JCZF	31	31	0	HOTAKA MARU
JDOC	13	13	0	HIEI MARU
JEMM	87	87	0	ASIA MARU
JFDG	108	108	0	SHUMPU MARU
JFZG	26	26	0	HAKUSAN MARU
JGZK	83	83	0	RYOFU MARU
JHJE	47	47	0	QUEENS WAY BRIDGE
JIOW	30	30	0	ALASKA MARU
JJZC	21	21	0	HAKONE MARU
JNTH	5	5	0	***
JPQX	69	69	0	CHOFU MARU
JPVB	78	78	0	SEIFU MARU
JQXW	8	8	0	HIERU MARU
KEOC	106	106	0	EDGAR M. QUEENY
KIYO	18	18	0	EXXON JAMESTOWN
KNBD	65	65	0	DELAWARE II
KVWA	17	17	0	TEXAS CLIPPER
MOP13	11	11	0	***
NAAO	67	67	0	GLACIER
NAEE	65	65	0	DE STEIGUER
NAQD	56	56	0	JARVIS
NBTM	10	10	0	POLAR STAR
NDWA	32	32	0	MORGENTHAU
NENC	28	28	0	SEALIFT PACIFIC
NGDF	15	15	0	MUNRO
NHOC	1	1	0	CURTS
NHPA	6	6	0	STARK
NHWD	1	1	0	MIDGETT
NIKA	53	53	0	SEALIFT ATLANTIC
NJOR	17	17	0	GALLATIN
NLVS	12	12	0	RUSH
NMST	11	11	0	MAHLON S. TISDALE
NNRJ	1	1	0	HULL
NPCR	25	25	0	DALLAS
NQRA	6	6	0	WORDEN
NRFJ	3	3	0	NORTHWIND
NUIT	13	13	0	HOLT
NZXF	12	12	0	SAMPSON
OXYL	18	18	0	BAMSA DAN
PGDG	42	42	0	NEDLLOYD KINGSTON
PGDU	41	41	0	NEDLLOYD KIMBERLEY
PGOF	44	44	0	NEDLLOYD KEMBLA
PJYG	63	63	0	OLEANDER
PLAT	113	113	0	PLATFORM
RB3063	2	2	0	***
SBCG	2	2	0	***
SCOU	3	3	0	TV 243
SCOV	9	9	0	TV 244
SCOW	2	2	0	TV 246
SCOZ	1	1	0	***
SCPE	5	5	0	TV 253
SCQG	1	1	0	TV 245
SCVB	2	2	0	***
SEXH	3	3	0	***
SEXQ	6	6	0	TV 278
SEYB	1	1	0	TV 273
SGOR	1	1	0	***
SGQJ	48	48	0	ELGAREN
SHIP	877	877	0	NO SHIP CALL SIGN REC'D
SHPF	2	2	0	TV 281
SHPH	1	1	0	***
SJTR	1	1	0	TV 271
SKVP	10	10	0	TV 284
SKVQ	1	1	0	***
SMZQ	4	4	0	TV102
SMZR	1	1	0	***
UAAH	1	0	1	***
UAAX	93	39	54	VOYKOV
UBNZ	128	123	5	SHULEYKIN AKADEMIK
UEAK	8	4	4	VALERIAN URYVAYEV
UFJJ	3	3	0	***
UFLN	1	1	0	***
UFLR	146	6	140	BOGUSLAV
UFOM	2	2	0	***
UFVZ	1	1	0	***
UGMU	2	2	0	***
UHOC	10	5	5	***
UHOS	100	49	51	ACADEMIC KOROLEV
ULFR	1	1	0	***
UMAY	310	142	168	ACADEMIC SHIRSHOV
UMFN	14	14	0	PROF. ZUBOV
UMJI	3	3	0	PROFESSOR VIZE
UMYM	13	0	13	RUDOLF SAMOILOVICH
UOJ	3	3	0	***
UOOF	283	1	282	NIKOLAI KONONOV
UOTJ	2	2	0	MIKHAIL VERBITSKIY
UUPB	184	86	98	AKADEMIK N. SHOKALSKIY
UUPW	1	1	0	***
UUQR	13	13	0	MOLCHANOV PAVEL PRO
UVMM	45	29	16	YAKOV GAKKEL
UWEC	200	94	106	KHROMOV PROFESSOR
UZGH	167	154	13	PASSAT
VCBT	28	28	0	CAPE ROGER
VKCK	53	53	0	STUART
VKCN	62	62	0	CANBERRA
VKCV	5	5	0	DERWENT
VKDA	107	107	0	DARWIN
VKLB	45	45	0	HOBART
VKMK	52	52	0	***
VKML	131	131	0	SNIPE
VKMN	65	65	0	TEALE
VKMS	280	280	0	COOK
VKPT	71	71	0	PERTH
VP09	16	16	0	AIRCRAFT SQUADRON
VXN	149	149	0	AIRCRAFT
WCBN	1	1	0	CHEVRON CALIFORNIA
WECB	50	50	0	MELVILLE
WHMJ	1	1	0	***
WHMW	2	2	0	EMPIRE STATE
WHTY	1	1	0	***
WMVC	8	8	0	J.N.COBB
WMVF	77	77	0	ALBATROSS IV
WRB3063	3	3	0	***
WTDF	62	62	0	T. CROMWELL
WTDK	36	36	0	D.S. JORDAN
WTDM	30	30	0	M.FREEMAN
WTDO	81	81	0	OREGON II
WTEA	6	6	0	DISCOVERER
WTEB	9	9	0	FAIRWEATHER
WTED	83	83	0	CHAPMAN
WTEF	6	6	0	RAINIER
WTEG	31	31	0	MOUNT MITCHELL
WTEJ	99	99	0	MCARTHUR
WTEK	20	20	0	DAVIDSON
WTEP	87	87	0	OCEANOGRAPHER
WTER	21	21	0	RESEARCHER
WTES	29	29	0	SURVEYOR
WTEW	39	39	0	WHITING
WXQ7334	19	19	0	PETER ANDERSON
WYB8082	8	8	0	DAY STAR
WYP5045	4	4	0	NAVIGATOR
WYR7512	34	34	0	BALD EAGLE
WYR9891	34	34	0	SEA HAVEN
WZL81	1	1	0	WESTWARD
Y3CH	24	0	24	PROF. ALBRECHT PENCK
3FHI2	78	78	0	MOANA PACIFIC
5MCB	9	9	0	PACMERCHANT
5MTA	39	39	0	PACMONARCH
7JBJ	4	4	0	RICHMOND BRIDGE
7JOB	16	16	0	SHINKASHU MARU
7KDD	29	29	0	YOKO MARU
8JIF	28	28	0	SHUNYO MARU
8JNZ	84	84	0	KOFU MARU
8JYI	4	4	0	***

TOTAL BATHYS RECEIVED 8185
TOTAL TESACS RECEIVED 1589
TOTAL REPORTS RECEIVED 9774

This listing represents BATHY-TESAC messages received at the Specialized Oceanographic Center (SOC), located at the U.S. National Meteorological Center (NMC). These ships participate in the collection and exchange of Integrated Global Ocean Services System (IGOSS) Data on the Global Telecommunications System (GTS).

Additional information on this program can be obtained by contacting:

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Camp Spring, Maryland 20233
Phone 301-763-8133

U.S. NDBC Climatological Data

April, May and June 1986

APRIL 1986			AIR TEMPERATURE (DEG C)							SEA TEMPERATURE (DEG C)							AIR-SEA TEMPERATURE DIFFERENCE (DEG C)						
BUOY	LAT	LONG	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN
32301	10.0N	105.0W																					
32302	10.0N	085.1W								719	30	26.8	01 21	26.1	22 13	26.5							
41032	32.3N	075.3W								717	30	23.0	01 01	22.0	27 05	22.5							
41036	29.3N	077.3W								711	30	24.5	21 09	20.3	11 08	22.9							
41037	34.2N	076.5W								719	30	24.6	28 22	21.8	20 08	23.3							
41038	29.2N	080.5W								017	01	22.2	01 16	20.3	01 06	20.7							
42001	25.9N	089.7W								718	30	25.1	08 19	22.6	01 00	23.4							
42002	26.0N	093.5W								655	29	25.8	09 22	22.2	04 08	24.3							
42003	26.0N	085.9W								698	30	26.9	30 20	22.3	01 06	24.8							
42007	30.1N	088.9W								719	30	23.5	30 23	17.8	01 02	20.1							
42039	29.3N	087.5W								379	17	24.4	28 21	21.1	16 11	21.9							
44334	38.5N	070.7W								719	30	19.8	02 21	13.2	19 22	15.2							
44011	41.1N	066.6W								042	04	14.5	20 23	10.6	20 09	13.5							
44012	38.8N	074.6W								017	05	13.2	28 22	10.1	02 23	11.0							
46311	56.3N	148.3W	097	06	00.1	09 21	-35.8	07 20	-02.4														
46032	42.5N	130.3W								718	30	11.6	20 23	10.2	07 11	10.6							
46003	51.9N	155.9W	028	02	00.1	07 20	-01.7	07 06	-00.6														
46005	46.1N	131.0W								004	03	10.0	07 00	10.0	06 23	10.0							
46013	46.2N	124.2W								427	29	12.0	20 21	10.0	01 38	10.5							
46011	34.9N	120.9W								717	30	15.5	20 22	11.3	30 13	13.1							
46012	37.4N	122.7W								718	30	14.3	21 01	10.1	29 14	12.1							
46014	39.2N	124.0W								361	24	12.3	08 20	10.0	05 01	10.9							
46016	63.3N	170.3W	240	30	00.8	12 23	-26.6	05 15	-10.2														
46022	40.8N	124.5W								584	30	12.1	01 05	10.0	17 17	10.8							
46023	34.3N	120.7W								715	30	16.2	20 23	11.1	27 07	12.7							
46025	33.6N	119.1W								717	30	18.9	19 21	13.9	09 06	15.6							
46026	37.8N	122.7W								678	30	14.1	08 20	10.0	17 06	12.1							
46027	41.8N	124.4W								174	14	11.2	08 22	10.0	03 16	10.4							
46028	35.8N	121.9W								718	30	14.6	20 23	11.4	29 17	13.0							
46030	40.4N	124.5W								423	23	13.0	09 02	10.0	11 00	10.9							
46035	57.0N	177.7W	166	11	00.1	03 11	-06.4	05 16	-01.9														
51002	17.2N	157.8W								719	30	26.4	07 01	25.6	01 15	26.0							
51003	19.2N	160.8W								718	30	25.8	19 03	24.6	13 13	25.1							
51004	17.5N	152.6W								720	30	25.7	04 03	24.9	09 16	25.3							
51005	20.3N	156.1W								717	30	25.3	16 23	22.9	09 16	24.6							
ALSF1	24.9N	080.6W								718	30	26.3	30 20	22.9	10 14	24.3							
CHLV2	36.9N	075.7W								318	23	13.5	30 20	10.0	01 23	11.1							
DBLM1	42.6N	079.4W	033	05	00.1	10 19	-01.8	22 15	-00.7														
DISD3	47.1N	090.7W	022	03	00.6	21 10	-03.0	22 09	-01.9														
FFIA2	57.3N	133.6W	021	04	00.1	19 13	-31.4	09 15	-00.6														
GDIL1	29.3N	089.9W								716	30	26.2	30 21	19.2	11 06	22.2							
GLLM1	43.9N	076.4W	016	02	00.2	22 19	-03.1	22 10	-01.9														
LNXF1	26.6N	080.0W								719	30	26.1	30 21	22.6	19 12	24.0							
PILM1	48.2N	088.4W	056	05	00.1	12 30	-37.0	21 13	-01.4														
ROAM1	47.9N	089.3W	038	05	00.1	12 11	-35.3	21 14	-01.4														
SGNW3	43.8N	087.7W	014	02	00.2	22 15	-02.4	22 10	-01.2	008	04	10.2	26 10	10.1	26 20	10.2	236	10	1-10.3	26 20	-12.6	22 10	-10.5
SVLS1	31.9N	080.7W								719	30	21.0	29 23	15.4	01 04	18.0							
TPLM2	38.9N	076.4W								469	25	14.5	30 23	10.0	01 05	11.5							

APRIL 1986			WAVE HEIGHTS (METERS)					FREQUENCY OF WAVE HEIGHTS (%)							
BUOY	LAT	LONG	OBS	MAX	DY HR	MEAN	<1M	1-1.5M	2-2.5M	3-3.5M	4-5.5M	6-7.5M	8-9.5M	>9.5M
32301	10.0N	105.0W	716	3.0	02 17	2.2			95.2	4.7				
32302	10.0N	085.1W	716	3.0	01 11	2.1		12.3	84.0	3.6				
41032	32.3N	075.3W	718	7.5	22 00	2.1	0.5	47.3	28.3	17.9	4.7	1.5		
41036	29.3N	077.3W	719	3.0	20 04	1.7	0.9	61.3	28.6	6.8	2.2			
41037	34.2N	076.5W	017	1.0	01 00	1.0		0.0						
42001	25.9N	089.7W	718	2.0	04 07	0.8	51.3	42.7	5.8					
42002	26.0N	093.5W	648	3.0	03 17	1.1	28.3	59.6	11.1	1.0				
42003	26.0N	085.9W	694	2.5	24 11	0.9	42.3	51.5	6.3					
42007	30.1N	088.9W	448	1.5	09 13	0.6	72.0	27.9						
42039	29.3N	087.5W	295	2.0	21 08	0.7	70.8	27.7	1.3					
44004	38.5N	070.7W	716	9.5	19 08	2.4	1.5	31.4	39.1	18.8	3.4	3.7	1.8	
44025	42.7N	068.3W	215	4.5	30 03	1.7	4.6	58.4	29.3	7.9	3.7			
44037	43.5N	070.1W	716	4.0	25 04	1.2	22.7	59.6	10.0	7.4	0.1			
44008	40.5N	069.5W	718	6.5	19 01	1.9	5.4	63.4	38.1	6.4	6.4	2.0		
44011	41.1N	066.6W	702	8.0	19 11	2.2	0.1	37.7	45.2	7.6	6.5	0.4	0.1	
46311	56.3N	148.3W	715	8.5	05 16	2.7		21.1	35.5	23.7	16.7	2.5	0.2	
46322	42.5N	130.3W	718	8.5	12 14	2.9		9.0	38.4	36.2	12.5	3.0	0.6	
46003	51.9N	155.9W	718	9.0	05 02	2.9		19.6	29.6	29.2	17.6	2.9	0.8	
46004	50.9N	135.9W	718	9.0	11 19	3.5		2.6	33.4	22.2	31.1	8.2	2.2	
46005	46.1N	131.0W	718	11.5	12 08	3.2		8.4	42.6	36.0	15.1	3.5	1.6	9.4
46313	46.2N	124.2N	716	9.0	25 21	1.9		38.3	42.6	13.1	2.9			
46011	34.9N	120.9W	716	4.5	13 15	2.2		32.9	38.8	24.3	1.8			
46012	37.4N	122.7W	715	4.5	24 07	2.2		32.8	40.2	24.8	1.9			
46314	39.2N	124.0W	158	4.5	25 05	2.9		5.0	37.9	45.5	11.3			
46221	40.8N	124.5W	715	7.5	12 23	2.8		12.4	49.5	18.3	17.4	2.2		
46223	34.3N	120.7W	709	4.5	13 16	2.3		26.8	38.9	30.6	4.3			
46025	33.6N	119.1W	717	2.5	17 01	0.9	38.3	58.1	3.4					
46026	37.8N	122.7W	715	3.5	13 06	1.8		49.0	49.6	0.2				
46027	41.8N	124.4W	686	6.0	13 00	2.5		14.7	54.9	21.4	8.7	0.1		
46028	35.8N	121.9W	717	5.0	24 12	2.5		22.8	35.9	29.5	11.5			
46035	57.0N	177.7W	716	9.5	09 11	2.8	1.3	31.5	26.2	12.9	20.8	5.4	1.5	
46125	33.8N	119.1W	717	2.5	17 01	0.9	33.0	63.4	3.4					
51002	17.2N	157.8W	719	9.0	09 10	2.6		9.7	41.7	46.3	2.2			
51003	19.2N	160.8W	718	5.5	10 22	2.5		9.3	64.0	20.4	6.1			
51004	17.5N	152.6W	720	4.5	09 19	2.7		3.1	50.4	40.6	5.6			
51005	20.3N	156.1W	719	5.5	10 16	2.5		10.3	51.4	30.3	7.8			
GLLM1	43.9N	076.4W	123	3.0	30 00	0.0								30.3

APRIL 1986			PRESSURE (MB)							WIND SPEEDS (KNOTS)				MEAN WIND SPEED (KNOTS)								
BUOY	LAT	LONG	OBS	DAYS	MAX	DY HR	MIN	DY HR	MEAN	OBS	MAX	DY HR	DIR	N	NE	E	SE	S	SW	W	NW	TOTAL
32331	18.0N	185.0W	719	30	1014.4117	17	1006.7112	22	1010.91	719	09132	15	290		5.01	6.71	6.31	5.01				96.51
32302	18.0N	085.1W	716	30	1016.5117	16	1012.2105	21	1015.31	716	21106	08	120	3.91	5.71	11.71	11.51	7.21	4.51	5.31	4.61	11.31
41002	32.3N	075.5W	711	30	1026.8105	15	999.6109	09	1015.91	708	29109	09	220	12.31	9.41	7.71	4.81	11.51	12.51	14.81	15.51	12.71
41036	29.2N	077.3W	719	30	1025.5106	15	1005.4109	20	1016.61	716	25129	21	310	11.11	9.41	8.01	6.11	10.41	12.21	12.31	13.21	11.21
41037	34.2N	076.5W	717	01	1023.9101	13	1021.9101	00	1022.71													
42031	25.9N	089.7W	718	30	1022.6124	16	1009.7112	22	1016.31	711	24105	16	120	9.31	10.51	10.91	13.31	7.71	6.31	9.01	10.81	10.61
42002	26.0N	093.5W	655	29	1021.9124	17	1007.6103	21	1015.21	654	28103	14	120	8.41	10.91	13.71	15.51	9.81	4.01	9.71	15.31	13.91
42003	26.0N	085.9W	697	30	1023.0124	16	1009.5113	08	1017.11	695	25104	07	120	9.61	9.21	10.51	14.21	14.41	13.01	13.31	9.91	10.81
42357	30.1N	088.9W	718	30	1025.6124	17	1008.4112	22	1017.21	701	27109	13	340	12.31	12.21	8.91	10.11	9.01	10.21	8.51	13.51	10.31
42359	29.3N	087.5W	379	17	1025.8124	17	1010.4120	21	1018.67	369	21122	05	360	11.81	8.51	7.51	8.01	6.31	8.31	9.31	10.51	08.71
44004	38.5N	070.7W	719	30	1028.3106	01	995.6109	13	1012.51	709	30118	23	010	17.31	13.91	13.71	11.51	12.61	10.71	14.61	13.31	14.61
44005	42.7N	068.3W	246	12	1032.9106	02	998.7110	09	1013.21	246	22105	18	340	18.41	12.81	11.81	15.11	9.51	8.11	5.31	9.41	10.41
44037	43.5N	070.1W	719	30	1034.9125	17	991.5110	18	1015.41	694	27123	12	010	11.71	11.61	7.91	9.61	9.01	7.91	5.51	7.81	09.21
44238	40.5N	069.5W	719	30	1031.1106	05	993.2110	06	1012.81	139	25106	18	360	11.91	11.81	12.01	6.11	6.01	5.01	6.01	7.31	10.51
44259	38.5N	074.6W	297	13	1028.6105	17	998.4108	20	1014.01	298	23110	05	290	8.21	9.51	6.41	6.01	6.71	3.01	11.91	10.31	08.81
44311	41.1N	066.6W	703	30	1031.7106	15	989.7110	06	1011.41	696	30119	03	030	12.41	16.81	9.21	12.01	8.91	6.91	9.71	9.01	12.21
44312	38.4N	074.6W	704	30	1029.1106	23	998.6108	22	1014.31	678	31118	13	310	14.91	9.71	7.41	10.01	9.91	6.41	7.61	12.61	09.71
44313	42.4N	070.8W	716	30	1033.5105	19	992.2110	08	1016.41	677	29125	12	020	12.91	12.31	6.61	9.11	8.01	6.11	6.71	6.61	09.31
44001	56.3N	148.3W	716	30	1031.8111	16	983.5105	10	1009.21	712	28105	20	260	10.81	10.41	13.41	12.91	11.61	14.51	15.71	16.31	14.41
46002	42.5N	130.3W	716	30	1032.8118	06	997.4130	23	1021.91	717	29112	09	310	14.71	16.51		20.11	15.31	13.11	11.61	14.91	13.51
46303	51.9N	155.9W	718	30	1037.7131	12	981.9102	06	1015.11	705	34104	23	230	13.81	9.61	3.81	14.71	16.11	15.51	16.41	16.21	15.71
46035	46.1N	131.0W	718	30	1035.4109	21	999.5130	23	1020.71	585	30112	02	300	9.41	6.51	25.61	16.81	15.21	10.51	13.91	11.91	12.91
46036	48.2N	124.2W	717	30	1031.4118	18	1009.4116	09	1019.41	692	27124	23	170	11.31	6.11	7.71	6.41	13.31	8.21	9.01	9.21	09.81
46011	34.9N	120.9W	717	30	1024.6117	18	1009.7105	13	1016.91	709	28102	06	310	6.91	9.81	5.61	8.01	7.51	6.21	7.71	14.31	12.41
46312	37.4N	122.7W	716	30	1026.3117	18	1009.1105	12	1018.11	716	27102	04	310	8.61	1.41	2.11	6.81	6.21	4.51	6.61	14.31	12.81
46014	39.2N	124.0W	717	30	1027.4117	19	1009.6105	13	1018.71	698	35123	03	320	11.51	3.41	4.11	8.31	7.31	4.11	4.01	16.51	13.41
46216	63.3N	170.3W	240	30	1030.1107	09	998.7115	03	1017.11													
46017	60.3N	172.3W	231	30	1037.2107	03	997.2115	03	1014.91	235	38109	18	110	14.31	9.91	18.01	17.91	11.91	8.01	9.71	10.01	13.61
46022	40.8N	124.5W	717	30	1030.1118	25	1010.4115	03	1019.61	705	32123	06	340	14.31	6.61	2.91	6.61	13.51	13.21	6.01	13.91	12.71
46023	34.3N	120.7W	715	30	1024.4108	18	1019.1105	12	1017.11	710	27102	09	340	13.61	3.71	7.91	7.91	9.61	3.21	6.71	15.51	14.31
46025	33.8N	119.1W	717	30	1024.2108	19	1010.0105	14	1015.71	678	25116	23	270	5.11	5.01	6.31	7.21	5.21	5.51	9.21	8.21	07.51
46026	37.8N	122.7W	717	30	1026.6108	19	1009.5105	11	1018.61	704	24102	08	300	2.71	2.91	2.21	6.81	7.41	4.91	11.41	14.41	11.71
46027	41.8N	124.4W	686	29	1030.5118	05	1010.3106	01	1020.31	218	37123	23	350	19.01	4.61	4.51	10.11	10.71	4.11	6.21	9.41	12.61
46028	38.8N	123.3W	718	30	1028.2118	18	1018.4105	13	1018.41	710	38129	05	320	13.51	3.71	4.91	8.01	6.21	4.01	3.31	15.01	14.11
46030	40.4N	124.5W	718	30	1030.2118	05	1011.3106	13	1020.01													
46035	57.0N	177.7W	718	30	1030.8106	19	994.2109	12	1013.21	716	33109	06	090	15.01	13.61	17.71	19.91	15.21	14.51	11.21	11.71	15.41
51002	17.2N	157.8W	719	30	1018.0102	20	1008.9110	14	1014.71	719	25109	17	060		16.41	16.31	13.01					16.11
51003	19.2N	160.8W	718	30	1019.5103	23	1010.1111	02	1015.71	718	29110	17	350	14.31	16.01	13.41	12.11	10.71				14.41
51004	17.5N	152.6W	720	30	1017.7103	19	1010.1109	14	1014.41	720	24109	08	360		15.41	15.31	12.71	13.01				15.31
51005	20.3N	158.1W	714	30	1018.3110	15	1010.3110	15	1015.11	718	31110	01	050	9.71	20.71	18.61	9.11					19.81
ALSF1	24.9N	080.6W	718	30	1022.7124	16	1009.3113	20	1017.11	690	25113	11	020	10.01	10.61	10.91	7.51	11.21	7.51	10.81	9.61	10.11
ALSN6	40.5N	073.8W	717	30	1032.5106	23	997.7109	20	1014.51	694	29117	00	110	15.11	14.61	22.31	14.21	10.01	12.21	7.01	11.71	13.71
BURL1	28.9N	089.4W	717	30	1026.0124	16	1009.4112	21	1018.01	708	27120	06	120	10.61	7.71	10.31	9.31	8.11	11.71	11.11	10.31	09.81
BUZM3	41.4N	071.0W	718	30	1033.8106	01	996.2110	07	1014.31	678	36118	18	030	18.01	19.21	12.11	11.01	9.11	10.61	8.31	8.81	13.41
CAPV3	43.3N	124.4W	718	30	1032.9118	06	1008.1112	13	1020.71	675	33115	22	190	15.61	7.31	2.41	5.21	14.21	10.21	10.31	6.21	11.01
CHLV2	36.9N	075.7W	717	30	1026.5124	23	998.2108	23	1014.21	684	38116	18	310	17.51	12.91	10.41	14.41	15.61	11.41	12.01	16.11	13.91
CLKN7	34.6N	076.5W	719	30	1026.9124	15	998.7109	08	1014.71	698	24109	16	340	12.61	9.61	7.31	5.21	8.21	10.21	9.21	14.61	09.21
CSBF1	29.7N	085.4W	716	30	1029.3124	16	1017.7109	04	1016.61	702	21122	02	230	9.61	3.61	5.21	5.11	5.31	8.61	8.31	9.91	08.51
DBLM6	42.6N	079.4W	680	30	1027.7124	12	993.0121	09	1015.01	672	31121	11	220	8.91	8.31	4.01	7.11	6.51	11.61	11.21	10.11	09.21
DESW1	47.7N	124.5W	719	30	1030.9118	18	1001.8125	02	1018.71	711	34126	23	130	7.61	5.41	4.51	14.61	10.41	8.21	9.61	14.31	11.21
DISW3	47.1N	090.7W	371	16	1027.1116	16	996.7128	22	1012.71	706	38126	04	050	11.11	15.51	8.31	9.41	7.61	14.21	10.31	13.81	12.91
DSLM7	35.2N	075.3W	749	30	1027.7104	16	998.4109	09	1014.91	693	36116	18	230	17.31	11.81	9.01	9.61	13.71	16.31	11.61	14.11	14.21
FBIS1	32.7N	079.9W	717	30	1024.1104	15	1002.5109	08	1015.51	712	29115	20	220	8.81	10.81	7.61	6.21	4.41	9.21	5.41	11.11	07.31
FFIA2	57.3N	133.6W	719	30	1029.2110	17	999.1127	03	1012.61	603	35120	12	230	11.51	9.01	9.41	15.21	14.41	7.61	9.01	9.91	11.91
FPSN7	33.5N	077.6W	718	30	1026.9124	15	999.9109	09	1015.41	701	36121	18	220	15.61	8.41	7.51	6.51	12.11	16.41	13.71	14.71	13.41
GDIL1	29.3N	089.9W	692	29	1025.3124	15	1008.7112	22	1017.31	694	27109	14	320	10.61	10.01	9.61	9.01	6.51	7.81	10.41	8.41	08.81
GLLN6	43.9N	076.4W	717	30	1029.7105	14	993.3121	14	1013.81	700	33106	15	160	6.81	8.61	7.91	11.61	15.01	9.21	13.21	9.61	10.71
IBSN3	42.9N	070.6W	718	30	1033.4105	17	991.2110	15	1014.11	695	35123	11	020	10.51	13.31	7.51	11.51	12.51	7.91	6.81	7.71	11.21
LKWF1	26.6N	080.0W	719	30	1023.8124	16	1007.3113	21	1017.01	711	25123	22	320	10.61	11.11	9.81	7.01	10.31	6.01	6.61	7.71	08.71
MDRM1	44.0N	068.1W	719	30	1033.7106	03	989.5110	09	1014.71	702	36107	18	100	14.71	17.71	12.91	13.41	11.51	10.71	7.61	8.91	13.41
MISM1	43.8N	068.9W	719	30	1033.9105	15	990.4110	08	1014.91	666	30122	03	150	13.11	14.51	11.91	15.11	11.61	9.21	7.71	10.21	12.31
MWPO3	44.6N	124.1W	718	30	1032.1118	09	1005.6112	13	1019.51	688	35115	23	190	14.41	3.61	4.81	4.61	13.01	11.01	10.91	10.71	10.21
NLNM1	48.2N	088.4W	718	30	1030.0124	17	997.3128	23	1016.61	682	33126	07	360	9.21	11.91	14.21	15.71	13.61	15.01	14.71	13.61	12.61
PTAC1	38.9N	123.7W	718	30	1026.9117	19	1009.1105	12	1018.41	693	35123	02	310	12.31	5.71	2.81	5.41	8.61	3.91	9.51	9.71	08.41
PTAT2	27.8N	097.1W	716	30	1021.6122	16	1004.2103	22	1014.41	716	31118	12	100	14.31	12.81	11.51	12.21	9.31	6.61	11.01	13.11	11.91
PTGC1	29.6N	120.7W	713	30	1029.2108	18	1009.6105	12	1016.51	677	35102	08	330	15.61	6.71	1.41	9.41	9.61	3.51	3.01	15.21	13.31
ROAM4	47.9N	089.3W	716	30	1029.3106	17	996.8129	01	1014.71	692	37124	05	210	16.51	15.11	14.51	16.31	17.11	15.11	14.51	11.71	15.31
SBIO1	41.7N	082.8W	690	30	1028.3123	16	997.6121	01	1015.51	672	27101	19	240	13.11	4.41	7.31	5.41	6.61	11.61	11.21	15.51	09.61
SDHV3	43.6N	087.7W	718	30	1026.5102	16	1022.3128	17	1014.81	654	28108	21	330	12.41	8.61	9.81	9.11	12.01	11.51	12.11	12.51	11.21
SISW1	49.4N	122.9W	717	30	1032.0118	23	1003.5125	03	1019.11	714	34107	08	310	2.91	5.51	5.91	13.01	10.61	7.51	10.21	5.81	08.31
SJLF1	30.4N	081.4W	718	30	1026.2124	16	1007.1109	08	1017.21	712	22109	16	310	8.31	8.61	6.41	7.61	9.11	7.61	8.21	8.11	07.91
SPSF1	26.7N	079.0W	718	30	1024.5106	15	1007.9113	21	1017.31	703	21117	05	300	5.91	6.81	7.81	6.71	2.71	4.51	1.91	6.61	06.21
SRST2	29.7N	094.1W	716	30	1024.1126	16	1008.1112	09	1016.41	706	25104	01	130	6.91	8.61	7.41	13.91	11.31	10.61	7.31	7.61	11.51
STDM4	47.2N	087.2W								688	38126	07	090	19.51	12.81	14.31	17.51	20.61	16.51	15.61	16.41	17.11
SVLS1	31.9N	080.7W	719	30	1026.4119	16	1004.4109	07	1016.31	711	29109	13	310	11.41	10.31	6.71	7.91	11.61	12.01	13.01	13.41	11.51
TPLM2	38.9N	076.4W	719	30	1028.4126	03	999.1108	19	1016.41	691	25116	03	010	9.41	8.01	6.71	5.51	5.21	2.81	9.81	13.41	09.21
TTIA1	48.4N	124.7W	718	30	1030.6118	08	1032.4125	03	1018.91	718	38130	17	080	3.51	8.71	13.11	11.61	12.11	10.01	14.11	9.51	12.31
WPOW1	47.7N	122.4W	716	30	1032.2118	16	1004.5125	05	1019.21	691	24125	12	190	6.61	5.61	2.41	4.81	11.01	8.51	4.41	2.31	08.01

APRIL 1986			TOTAL FREQUENCY OF WIND SPEEDS (%)						TOTAL FREQUENCY OF WIND DIRECTIONS (%)							
BUOY	LAT	LONG	CALM	<4KT	4-10KT	11-21KT	22-33KT	34-47KT	>47KT	N	NE	E	SE	S	SW	W	NW
32331	18.0N	185.0W		0.3							<.05	96.7	93.2	0.1			
32302	18.0N	085.1W	0.3	1.8	42.1	55.9				0.5	3.5	96.3	55.9	3.2	0.7	0.5	3.5
41002	32.3N	075.3W		8.1	26.0	61.6	4.3			15.7	13.8	4.1	1.4	10.3	21.3	19.8	13.5
41036	29.3N	077.3W		3.5	40.8	54.1	1.7			15.2	12.3	9.3	3.0	6.3	16.8	20.4	16.8
42031	25.9N	089.7W		2.8	46.3	49.8	1.4			5.6	16.3	48.2	18.1	2.6	2.6	1.0	3.3
42002	26.0N	093.5W		0.9	23.9	70.3	4.9			2.5	9.4	32.9	48.0	5.9	<.05	0.3	1.1
42003	26.0N	085.9W		3.2	48.8	46.2	1.9			10.9	29.2	36.1	12.5	4.7	1.8	2.8	2.1
42007	30.1N	088.5W		7.8	48.6	39.7	1.9			5.1	8.4	19.1	19.1	19.1	14.0		9.7
42009	29.3N	087.5W		9.2	59.4	31.2				8.9	12.1	10.9	15.1	16.1	11.6	14.6	13.6
44334	38.5N	070.7W		4.2	23.4	58.8	12.3	1.3		32.5	12.4	10.6	4.7	6.1	9.7	15.8	12.9
44005	42.7N	068.3W		4.9	53.3	41.5	0.4			12.0	9.7	7.4	16.1	22.0	12.5	9.7	11.7
44007	43.5N	070.1W	5.0	11.5	54.6	32.7	1.2			16.8	19.6	10.0	8.2	22.3	10.7	4.8	8.7
44008	40.5N	069.5W	2.9	5.8	54.0	36.5	0.8			16.6	15.6	7.5	11.8	23.1	7.8	5.1	12.5
44309	38.5N	074.6W	5.5	10.5	54.8	34.5	0.3			10.3	26.1	15.2	3.9	12.7	1.9	14.3	15.8
44311	41.1N	066.6W		6.6	39.4	43.2	10.6	0.1		22.7	28.8	13.8	8.9	6.4	6.1	6.5	9.8
44312	38.8N	070.6W	8.6	13.6	47.5	35.0	4.8			9.7	15.8	16.6	9.9	8.6	6.8	15.4	16.1
44313	42.4N	070.8W	5.8	10.8	57.5	27.5	4.3			16.7	18.6	8.8	19.1	10.5	12.2	6.1	8.0
46001	56.3N	148.3W		5.1	22.3	66.4	12.2			7.2	8.1	6.3	6.9	5.1	11.3	33.0	23.1
46002	42.5N	130.3W		2.0	30.3	62.5	5.2			24.1	2.8		2.0	3.6	13.6	22.9	29.1
46003	51.9N	155.9W		3.1	13.6	69.2	13.3	0.7		4.4	2.2	0.5	5.3	6.4	12.5	45.3	23.3
46005	46.1N	131.0W		2.2	32.9	56.2	8.7			9.1	8.3	2.0	2.3	7.8	12.2	39.3	27.4
46131	46.2N	124.2W	5.1	9.8	48.4	39.3	2.5			19.9	2.3	6.5	2.6	14.5	15.0	17.6	21.4
46211	34.9N	120.9W		7.3	36.8	45.8	10.0			8.6	2.4	1.9	3.8	3.1	1.2	5.4	73.4
46212	37.4N	122.7W		8.8	39.5	50.6	1.1			8.3	2.4	0.7	1.0	5.2	3.0	0.8	78.6
46214	39.2N	124.0W		5.7	31.5	49.9	12.9			18.0	1.8	3.0	8.1	6.2	1.5	2.0	60.2
46217	60.3N	172.3W		7.7	30.2	46.4	15.3	0.4		30.2	9.1	7.7	22.2	8.6	12.2	3.6	6.3
46222	40.8N	124.5W		7.5	30.8	54.6	7.1			17.3	2.7	3.6	4.5	12.7	9.0	1.3	19.8
46223	34.3N	120.7W		5.2	24.4	58.5	11.8			15.7	0.6	4.1	4.3	1.8	0.2	2.3	71.0
46225	33.8N	119.1W		17.7	61.1	19.3	1.9			7.8	2.7	6.9	6.8	8.8	11.5	37.1	21.0

APRIL 1986			TOTAL FREQUENCY OF WIND SPEEDS (%)							TOTAL FREQUENCY OF WIND DIRECTIONS (%)							
BUOY	LAT	LONG	CALM	<1KT	1-10KT	11-21KT	22-33KT	34-47KT	>47KT	N	NE	E	SE	S	SW	W	NW
46026	37.8N	122.7W		11.1	29.7	53.8	5.4			1.8	1.8	1.4	2.6	6.0	5.6	31.8	49.3
46027	41.8N	124.4W	0.5	7.3	48.2	28.6	13.3	2.0		37.2	4.6	4.5	12.5	16.4	2.8	4.5	17.7
46028	35.8N	121.9W		5.8	26.6	50.7	16.9			6.4	1.5	4.3	6.4	8.8	8.3	1.6	79.0
46035	57.0N	177.7W		1.6	17.5	69.8	11.3			20.6	9.2	6.4	19.0	13.6	10.1	7.8	7.3
51002	17.2N	157.8W		0.3	2.9	94.8	2.8				6.3	86.6	7.1				
51003	19.2N	160.8W		0.3	14.5	76.3	8.8			0.1	45.1	43.7	10.5	0.6			
51004	17.5N	152.6W			8.3	89.2	2.1				36.3	61.6	2.0	0.1			
51005	20.3N	155.1W	0.7	0.7	4.7	63.8	30.8			0.2	61.9	37.2	0.7				
ALAF1	24.9N	080.6W	2.8	10.6	41.8	47.2	0.4			11.9	23.5	29.0	6.1	3.2	7.5	10.1	8.6
ALSN6	40.5N	073.8W	2.7	8.8	29.5	44.7	13.8	3.2		19.2	11.3	13.2	8.8	12.1	13.8	9.8	10.4
BUSL1	28.9N	089.4W	3.8	11.3	44.9	38.3	3.5			7.9	12.8	33.7	19.2	7.9	10.3	4.3	4.9
BUZM3	41.4N	071.0W	3.2	9.6	31.1	42.5	13.4	1.3		18.7	21.4	8.3	9.1	14.3	13.0	9.6	5.5
CAR03	43.3N	129.4W	5.9	16.7	36.7	36.0	10.5			29.7	13.0	4.9	8.3	17.5	11.2	6.2	9.2
CHLV2	36.9N	075.7W	1.5	5.8	27.0	51.6	14.9	0.6		10.6	18.4	14.1	8.7	12.6	7.2	9.9	18.5
CLKN7	34.6N	076.5W	1.8	7.6	48.1	35.3	1.0			9.2	15.1	5.9	3.8	9.6	20.7	13.8	19.9
CSAF1	29.7N	085.4W	4.1	20.9	64.4	10.7				9.1	5.8	6.1	9.9	8.4	18.6	28.8	13.4
DBLN6	42.6N	079.4W	3.6	17.3	42.0	36.6	3.1			3.9	21.2	8.1	6.4	9.6	28.8	15.8	6.3
DESW1	47.7N	124.5W	2.8	11.1	37.8	48.6	4.3	0.1		2.4	8.4	7.2	21.8	13.1	9.8	10.8	27.3
DISW3	47.1N	090.7W	2.8	8.9	32.9	45.3	12.6	0.6		6.9	41.9	6.2	3.5	9.1	19.4	6.5	7.3
DSLN7	35.2N	075.3W	2.5	8.9	24.4	47.8	16.5	0.4		17.6	9.1	3.1	5.8	8.9	25.5	14.9	15.0
FBIS1	32.7N	079.9W	2.5	16.3	64.9	16.5	0.3			6.3	3.0	2.9	7.1	12.7	32.4	20.1	15.3
FFIA2	57.3N	133.6W	7.6	13.4	33.5	40.5	12.4	0.2		19.2	10.4	6.4	33.4	23.9	4.1	1.5	2.5
FPSN7	33.5N	077.6W	3.8	5.8	34.2	44.8	11.8	0.3		7.0	7.6	4.6	5.1	11.8	25.4	22.6	15.9
GDIL1	29.3N	089.9W	2.3	10.8	56.2	32.3	0.7			6.1	6.7	14.6	36.5	15.8	7.3	5.8	7.2
GLLN6	43.9N	076.4W	3.6	7.7	46.6	39.7	2.9			7.7	21.7	6.4	7.7	13.1	11.5	26.9	6.9
IOSW3	42.9N	070.6W	2.3	9.2	39.9	42.2	6.4	0.1		15.7	21.6	6.6	18.4	13.6	9.9	7.0	7.2
LKWF1	26.6N	080.0W	0.6	6.2	63.3	30.5				5.8	18.4	23.4	9.6	7.3	8.6	15.8	10.9
MDRM1	44.0N	068.1W	3.6	8.0	30.1	47.9	13.8	0.3		12.7	25.7	11.3	10.4	15.3	11.9	5.8	6.9
MISM1	43.8N	068.9W		6.3	36.6	49.7	7.4			16.7	23.4	8.4	9.8	18.3	13.2	4.4	6.6
NWP03	49.6N	126.1W	0.9	14.5	40.7	39.8	4.8	0.1		18.9	8.0	15.8	2.4	16.9	10.8	11.3	16.8
PILM1	48.2N	088.4W	2.3	5.6	30.1	55.4	6.9			14.8	27.7	16.3	6.2	6.0	8.0	10.4	10.6
PTAC1	38.9N	123.7W	3.4	12.8	43.3	41.7	2.6			57.7	9.7	3.7	7.7	11.0	3.1	1.0	6.1
PTAT2	27.8N	097.1W		1.0	32.4	65.4	1.0			2.1	9.0	24.6	56.5	6.7	0.3	0.1	0.7
PTSC1	34.6N	120.7W	5.2	10.9	27.9	40.9	20.1	0.2		62.6	2.2	0.8	8.8	9.7	0.3	1.5	15.6
SDAN6	47.9N	089.3W	1.4	5.9	25.4	48.5	19.8	0.3		10.1	33.5	17.9	4.4	5.2	8.6	12.8	7.5
SBIO1	41.7N	082.8W	2.8	12.9	49.3	34.8	3.8			10.6	7.4	31.0	5.5	7.7	13.5	10.4	13.7
SGNW3	43.8N	087.7W	2.6	6.7	37.0	52.9	3.4			16.9	14.7	6.3	6.7	26.2	8.7	11.0	9.4
SISA1	48.3N	122.9W	4.9	20.9	43.3	29.1	0.6	0.1		4.0	3.9	5.7	18.9	13.3	6.8	36.2	11.2
SJLF1	30.4N	081.4W	1.3	10.5	68.5	20.8	0.1			5.9	6.5	11.3	16.0	9.9	9.6	20.1	11.5
SPGF1	26.7N	079.0W	14.4	30.2	49.8	20.1				7.8	22.8	25.3	5.2	4.9	10.3	4.1	19.9
SRST2	29.7N	094.1W	0.6	4.5	37.3	55.9	2.3			5.5	8.8	3.5	45.0	29.3	5.2	3.0	4.6
STDM4	47.2N	087.2W	1.0	4.2	14.2	51.9	29.4	0.3		13.2	12.5	17.8	16.3	16.1	3.3	11.7	9.1
SVLS1	31.9N	080.7W	2.1	7.0	39.5	47.0	4.5			4.5	4.4	3.1	11.8	26.3	18.8	15.0	16.0
TPLM2	38.9N	076.4W	4.5	12.9	46.9	34.0	1.4			12.8	13.9	12.1	12.4	15.8	3.9	12.4	22.1
TTIW1	48.8N	124.7W	2.5	6.8	32.9	50.3	7.4	0.3		1.9	3.5	15.6	11.4	19.9	15.9	27.5	4.8
WPO41	47.7N	122.4W	4.8	21.3	49.5	27.9	1.3			11.8	21.6	4.9	9.1	44.0	6.7	0.5	1.5

May and June Buoy Data unavailable at this time due to program malfunction

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